AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

Brig. Gen. Chester W. Clarke, USA

Reports on Army-Industry Teamwork

JUNE 1, 1960

ALSO IN THIS ISSUE

NEW MULTIFUEL DIESEL ENGINE

FORGING VALVES AT HIGH RATE

SIMCA ARONDE PLANT BOOSTS CAR OUTPUT

HOW MACK TRUCK PURCHASES STEEL

MANAGEMENT
ENGINEERING
DESIGN
PRODUCTION

Allis-Chalmers uses **RYKON** *Grease: in bearing shield —offers farmers better disc harrow*

Situation: Bearings of a disc harrow in service are always turning in dusty conditions, oftentimes completely covered with soil. Such bearings in the Allis-Chalmers harrow are protected with grease-coated rubber shields. The grease guards against dirt getting past the shield and into the bearing.

What was done: Allis-Chalmers project engineer in the LaCrosse, Wisconsin plant, Maynard Walberg, called Fred Parkinson, Standard Oil lubrication specialist, for a sample of RYKON Grease. In conditions simulating field service, RYKON Grease was tested. Bearings were rotated in the most abrasive dirt available—Mississippi sand with a high quartz fraction.

What happened: Tests were started and run to destruction. Prior to the use of RYKON Grease, bearing failures occurred at 500 hours. On switching to RYKON Grease, these tests were pushed to 2,000 hours. At this point, tests were stopped. Bearings were still in operating condition.

What you can do: Find out how RYKON Grease might help you offer your customers a better product. Inquire of the Standard Oil lubrication specialist nearest you anywhere in the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Can RYKON Grease help you improve your product?

You expect more from **STANDARD** *and you get it!*

Maynard Walberg, Allis-Chalmers project engineer, and Standard Oil lubrication specialist Fred Parkinson, examine disc harrow bearing assembly. Fred is well equipped through training and experience to help industrial customers with lubrication problems. He has been doing this work for 11 years at Standard. He has a degree in chemistry and engineering from Brown University. Plus that, he has completed the Standard Oil Sales Engineering School.

Quick facts about RYKON Grease

- Heat stable. At sustained high temperatures RYKON Grease remains soft and grease-like.
- Resistant to water-washing.
- Mechanically stable. Minimum change in consistency in service.
- Resistant to oxidation. Thickener acts as an inhibitor.
- Exceptional rust-preventive properties.

37 INDUSTRIES BENEFIT FROM T & W's WIDE RANGE FACILITIES, EXPERIENCE

You benefit from the broad range of T & W facilities and experience. By being the producer which has wide-range facilities to serve all American industry, T & W can afford to put more plant, more know-how at *your* service, without an increase in overhead burden. Also, what we learn in doing diverse jobs helps us do a better job in producing forgings and stampings for automotive use, aircraft components, parts for agricultural machinery and construction equipment.

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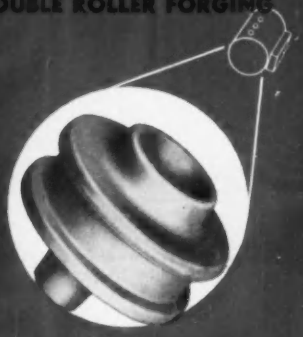
SPOTLIGHTING HOW WIDE RANGE FACILITIES HELP INDUSTRY:

☆

CYLINDER HEAD COVER STAMPING

This cover, 18" long, 6⅜" wide, 4¼" deep, benefited from the wide ability of T & W in producing rugged, non-warping items of similar complex design.

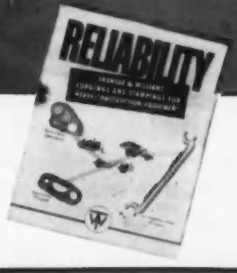
DOUBLE ROLLER FORGING



A critical 117-lb. forging (with 12" max. diameter), which required expert die design to control grain flow, for strength and toughness.

WRITE FOR MORE INFORMATION

The Leaflet "Reliability" explains engineering help and other facilities, and the experience, which enable T & W to serve you better. Write for it.



FORGINGS & DEEP DRAWN STAMPINGS

TRANSUE & WILLIAMS

ALLIANCE • OHIO, U. S. A.

Circle 101 on Inquiry Card for more data

Circle 104 on Inquiry Card for more data

Payload of a Haulpak is greater than weight of the truck itself. From engine to final drive, nickel alloys help Haulpaks pay off on roughest hauling jobs.

Here's where 8 nickel alloy steels deliver critical off-road stamina

In the transmission and drive—murderously stressed by off-road shock loads — five nickel alloy steels, each doing a specific job to provide vital strength, toughness and wear-resistance. Examples: in some models, quenched-and-tempered AISI 8642 steel for drive shafts. In other models, carburized-and-hardened nickel alloy steels for shafts and gears: 4820 Ni-Mo, 3310 Ni-Cr, and 8620 Ni-Cr-Mo. For final-drive components, 4320 Ni-Cr-Mo and 4820 Ni-Mo; both provide core strengths in the 150,000-200,000 psi range, and high case hardness for wear-resistance.

In the engine, strategic use of nickel alloys helps raise power outputs, economically. Extra-rugged timing gears in the Cummins Diesels are made of AISI 4340 nickel alloy steel for long-range wear-resistance. Ductile Ni-Resist* Irons — with outstanding resistance to high-temperature oxidation — are used for turbocharger housings, exhaust manifolds, and inserts for fuel-saving lightweight pistons.

In the body, nickel alloy steels slash deadweight, cushion shocks dependably. The Haulpak's sloping, one-piece floorplate is T-1 Steel**, containing Nickel and other elements. Three times stronger than standard steel, "T-1" may be used in thinner, *lighter* section. Result? Weight-savings that make the loaded Haulpak 60% *pay*load. With or without load, the Haulpak rides level and smooth on four-point air-hydraulic suspensions, built around wear-resisting pistons forged from 8630-H nickel alloy steel.

In your equipment, nickel alloy steels can provide the same toughness, strength and wear-resistance that are built into the Haulpak. For complete engineering data on nickel alloy steels, simply write Inco.

*Registered trademark, International Nickel Co.
**Registered trademark, U. S. Steel Corp.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

JUNE 1, 1960

Passenger Cars • Trucks • Buses • Aircraft • Tractors • Engines • Bodies • Trailers • Road Machinery • Farm Machinery • Parts and Components • Accessories • Production and Processing Equipment • Design • Production • Engineering • Management

VOL. 122 No. 11

Features • • •

▼ Vehicle Design Developments by Army-Industry Teams

In an exclusive interview, Brig. Gen. Chester W. Clark, USA, tells of advances in mobility of the United States Army. Page 33

▼ Continental's New Multifuel Engine

The Continental LDS-427 Diesel operates on any of the fuels usually available at U. S. Military field depots. Page 36

▼ Valves Forged at High Rate at Chevrolet Plant

Inlet and exhaust valves are forged in automatic setups at No. 5 Plant at Chevrolet Division, GMC, Flint, Mich. Page 38

▼ Making GMC V-6 and V-12 Engines

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▼ New Standards for Ball and Roller Bearings

Reduction of cost in making and distributing ball and roller bearings is expected to result from the new American Standard Identification Code. Page 44

▼ Ford's Expansion in England

Ford Motor Company's modernization and expansion program in England is claimed to be the most ambitious in the European automobile industry. Page 46

▼ Simca Boosts Car Output

Automation is widely applied to the assembly of unitized Aronde bodies at the Simca Aronde plant near Paris. Page 48

▼ How Steel Products Are Bought at Mack Trucks

A team of representatives from Purchasing, Engineering, and Manufacturing acts as a clearing house for all material purchases at Mack Trucks, Inc. Page 51

▼ 23 New Product Items and Other Features Such as:

Machinery News, Metals, Airbriefs, and Our Washington Wire.

. . . continued on next page

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MEMBER SBME Society of Business Magazine Editors

NBP National Business Publications, Inc.

BPA Business Publications Audit of Circulation

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R/M engineers helped marine transmission manufacturers solve clutch problems for this 55-ft. Chris-Craft Constellation. Twin engines develop up to 550 hp, provide speeds to 23 mph; equipped with newly designed hydraulic aluminum marine transmissions with R/M sintered bronze clutch material.

Photo courtesy Chris-Craft

How Raybestos-Manhattan helped design clutch for new marine transmission

"The extensive friction material knowledge and experience of R/M engineers save us time and money when we are working on a new design for a clutch or friction part," says Carl Benson, assistant manager and chief engineer, Paragon Gear Works, Taunton, Mass.

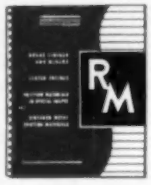
Solve problems on spot

"In developing our new 'H-A' hydraulic aluminum transmission, we took an R/M engineer right with us to our customer's engine plant in Michigan. We solved our clutch problems on the spot.

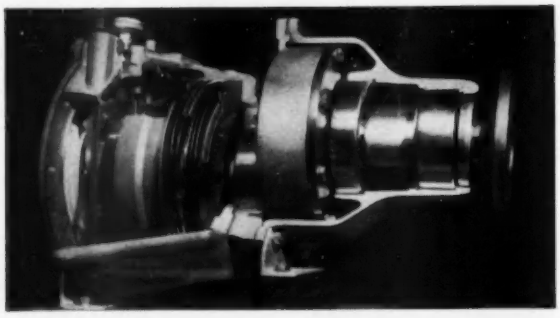
"Our customers appreciate this extra engineering service we can offer them through R/M. Wherever we are we know we can pick up the phone and have the nearest R/M engineer come to us. We get this extra service, yet prices are competitive; quality is uniformly high."

Save time, money

You may also be able to save time and money by calling on experienced R/M engineers to help solve your friction problems. You can depend on sound, unbiased counsel on the material best suited for your application—for only *R/M manufactures all types of friction materials!* An R/M sales engineer can be at your desk within 24 hours.



Send now for your free copy of Bulletin No. 501—packed with helpful engineering information on friction materials.



Advanced-design Paragon "H-A" hydraulic aluminum transmission for Chris-Craft 430 engine which develops 275 hp at 4000 rpm. Clutch is self-compensating; no adjustment ever.

Pencil points to R/M sintered metal clutch facing. .015 in. of sintered bronze on .070 in. steel plate. Has a high coefficient of friction in presence of oil; strength to withstand 4000 rpm; precision operation within narrow clearances of .007 to .010 in.

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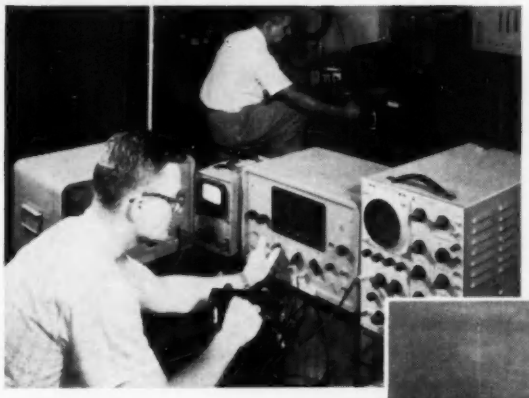

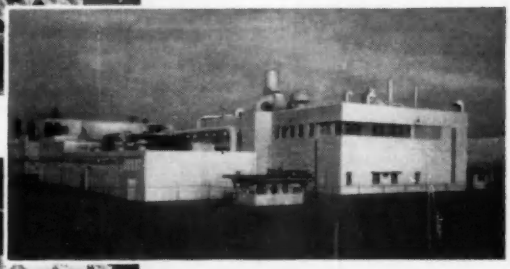

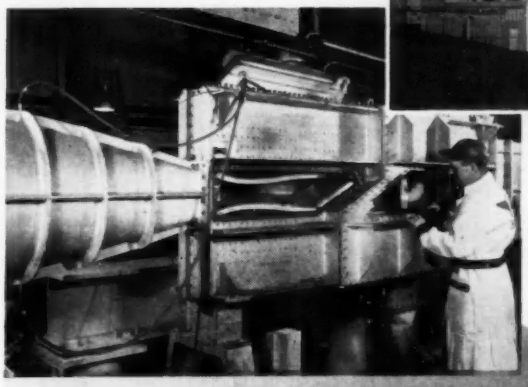

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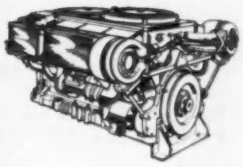

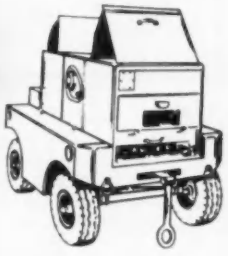

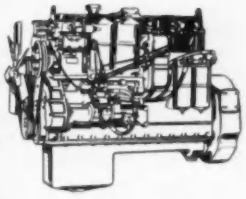

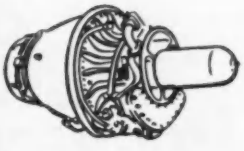

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Service Minded Equipment Company Uses Ermeto Fittings on Self-Supporting Hydraulic System for "Jeep-A-Trench"

Trenching operations subject digging ladders to varying shock loads. The "Jeep-A-Trench" is equipped with a hydraulic lift which cushions these loads to reduce service and maintenance requirements in the shop and in the field.

Idea sumbitted by:
Mr. WARREN E. GEORGE
Auburn Machine Works, Inc.
Auburn, Nebraska

In developing the "Jeep-A-Trench", Auburn's engineers considered two important factors: digging in all types of soils subjects any trencher to varying shock loads; and, their equipment must operate in any terrain under all types of conditions. For these reasons, they perfected a hydraulic lift for the digging arm of the "Jeep-A-Trench" that would be as nearly service-free as possible.

"We used steel tubing on our hydraulic system because it withstands greater stresses, does not require the maintenance of rubber covered flexible tubing and it is self-supporting. It is simpler to service," explained Mr. George.

"ERMETO hydraulic fittings were selected because Weatherhead had technical service facilities available all over the U. S. to help service the equipment in case of difficulties."

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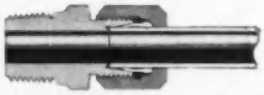

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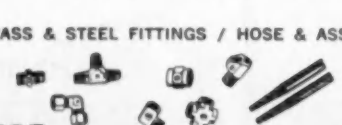

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CALENDAR

OF COMING SHOWS AND MEETINGS

ASME Summer Meeting and Aviation Conference, Dallas.....June 5-9

SAE Summer Meeting, Chicago.June 5-10

AGMA (Gear Mfrs.) Annual Meeting, Hot Springs, Va. .....June 6-8

Material Handling Institute, New England Show, Boston .....June 6-8

International Powder Metallurgy Conference, New York City June 13-17

American Society for Testing Materials, 63rd annual meeting Atlantic City .....June 26-July 1

International Trade Fair, Chicago June 20-July 5

1960 Western Packaging & Materials Handling Exposition, Los Angeles .....July 19-21

11th Annual Industrial Research Conference, Harriman, N. Y. Aug. 7-13

American Astronautical Society, Western National Meeting, Seattle .....Aug. 8-11

International Heat Transfer Conference, sponsored by ASME, American Society of Chemical Engineers, and IME, ICE (British) .....Aug. 28 to Sept. 1

Machine Tool Exposition—1960 (sponsored by National Machine Tool Builders' Assn.), Chicago Sept. 6-16

Production Engineering Show, Chicago .....Sept. 6-16

2nd Coliseum Machinery Show, Chicago .....Sept. 7-15

ASME Engineering Management Conference, Cambridge, Mass. Sept. 7-9

Fall Meeting, Material Handling Institute, Virginia Beach, Va. Sept. 12-13

Steel Founders' Society of America Fall Meeting, Hot Springs, Va. Sept. 18-20

AWS, National Fall Meeting, Pittsburgh .....Sept. 26-30

Cast Bronze Bearing Institute, 1960 Annual Meeting, Asheville, N. C. Oct. 12

43rd National Automobile Show, Cobo Hall, Detroit .....Oct. 15-23

42nd National Metal Exposition and Congress, Philadelphia ....Oct. 17-21

SPI, "Tooling for the Plastics Industry," New York City .....Oct. 19

1960 Fleet Maintenance Exposition, New York City .....Oct. 24-27

15th Annual Technical Convention, American Society of Body Engineers, Detroit .....Oct. 26-28

ASTME, Western Tool Show, Los Angeles .....Nov. 14-18

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COOLTEX, the *new* chemical grinding coolant, gives you better finishes because it keeps the work *cooler* . . . keeps the wheel from loading. Actually lets you use a *finer* grit! COOLTEX is transparent, so you can *see* the work — and it keeps machines noticeably cleaner. Your Texaco Lubrication Engineer is mailing COOLTEX idea postcards now. Watch for yours. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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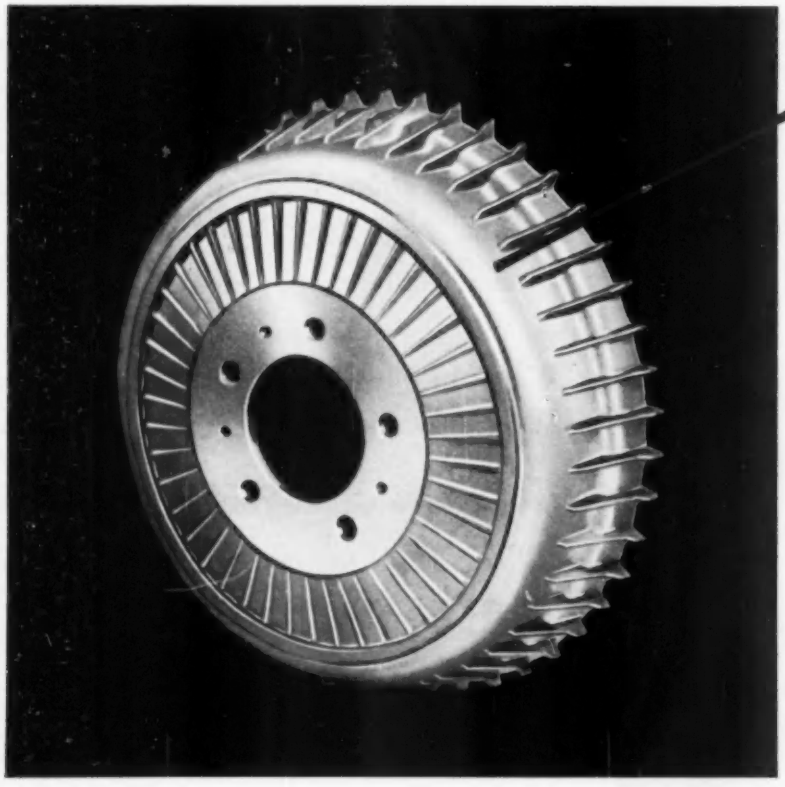
In any application, Central Foundry aluminum castings have many inherent advantages, including light weight, machinability, corrosion resistance and excellent heat and electrical conductivity.

FRONT BRAKE DRUM



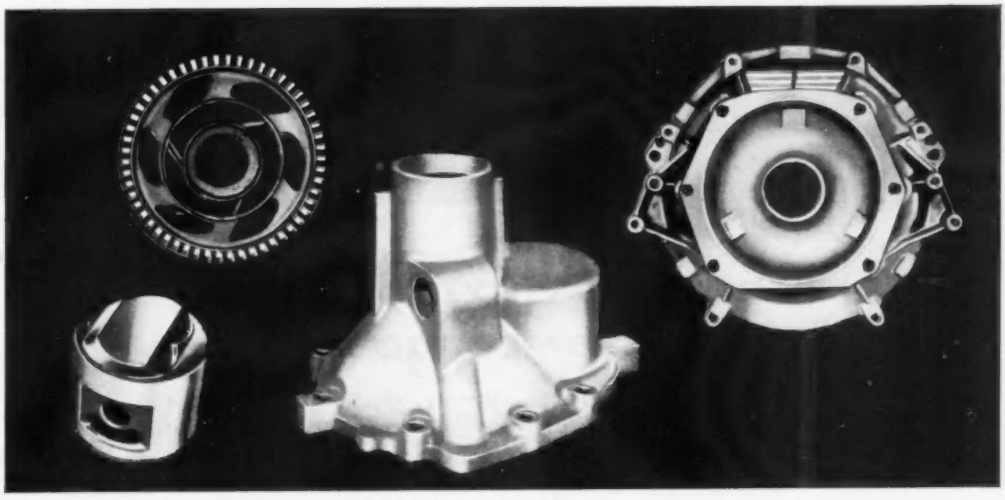
For assistance in the design, alloy specification and in the choice of the casting method best suited to the production of your part—write today for the new 24-page book on Aluminum Castings or ask for a Central Foundry sales engineer to call.

BRAKE DRUMS SURELY...

1960 TURBINE DRIVE BUICK LESABRE

TRANSMISSION STATOR

FLYWHEEL HOUSING



PISTON

REAR BEARING RETAINER

ALUMINUM CASTINGS FOR AMERICA'S NEW CARS

Dozens of automobile components are being developed, tested and produced in aluminum which are greatly aiding car manufacturers in their efforts to lower weight, reduce costs and, at the same time, increase the economy and performance of their cars.

A FEW OF THE HUNDREDS OF ALUMINUM CASTING APPLICATIONS INCLUDE:

Intake Manifold	Oil Pan
Water Pump Body	Oil Pump Body
Timing Chain Cover	Transmission Case
Water Outlet	Steering Gear Housing
Brake Master Cylinder	Differential Carrier

CENTRAL FOUNDRY DIVISION · GENERAL MOTORS CORPORATION

CENTRAL FOUNDRY DIVISION

GENERAL MOTORS CORPORATION • SAGINAW, MICHIGAN DEPT. 24

97

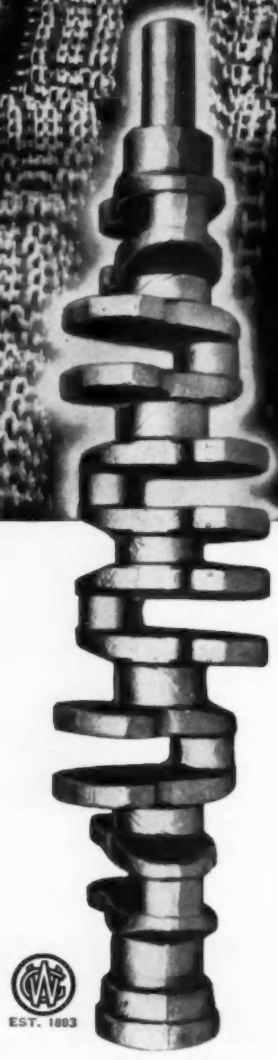
Circle 111 on Inquiry Card for more data

On their way to move men, merchandise—or mountains

For a nation on wheels and on the wing—a production run of forged crankshafts and jet engine compressor wheels for the builders of power-plants for pleasure cars, trucks, earth-moving equipment, and aircraft.

In missile development, too, Wyman-Gordon has proved the value of forging in achieving the highest strength-weight ratios, at elevated temperatures.

With forging experience dating prior to the birth of the internal combustion engine; with the greatest hammer and press capacity in the country; with unexcelled laboratory facilities; Wyman-Gordon is anxious to serve you at the design, engineering and purchasing stages of your developments.



WYMAN-GORDON

FORGINGS

of Aluminum Magnesium Steel Titanium . . . and Beryllium Molybdenum Columbium and other uncommon materials

HARVEY ILL. WORCESTER MASSACHUSETTS DETROIT MICH.

GRAFTON MASS. FRANKLIN PARK ILL. LOS ANGELES CAL. PALO ALTO CAL. FORT WORTH TEX.

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LETTERS to the Editor

Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

READER PROFILES

Letters to the Editor are often considered to be a measure of editorial integrity, reader interest and industry penetration. A recent study of the letters to this department reveals that readers are using AUTOMOTIVE INDUSTRIES to translate a great number and variety of industry problems, products and processes into significant and usable information.

CLASSIFICATION BY TITLE AND FUNCTION	Per Cent. Total
Management	14.6
Manufacturing	11.2
Engineering	22.6
Sales & Public Relations	14.6
Association Executives	15.7
Purchasing	2.2
Others	19.1
CLASSIFICATION BY PRODUCT	
Vehicles & Automotive Suppliers	34.7
Production Equipment	16.0
Materials	17.3
Associations	17.3
Others	14.7
CLASSIFICATION OF LETTERS	
AI Plaudit	38.2
Requests for Reprints	14.6
Technical & Product Information	23.6
Market Information	2.2
Specification Tables	2.2
Chilton Books	2.2
Back Issues of AI	1.2
Permission to Reproduce Technical Reports and Editorials	4.5
Information Forwarded by Reader	7.9
Critical Comments	1.2
Reader Service	2.2

The Editors welcome inquiries from readers on all subjects pertinent to automotive design, production, engineering and management.

MATERIALS HANDLING

Your recent article "Latest Production Methods at Plymouth Assembly Plant" was of particular interest to all of us here at Chain Belt Company. Of particular interest, because the final assembly line is our Rex Chain belt chain.

Would you please send me 150 reprints of this article so we can distribute them to our Field Force Engineers. Being the longest assembly line conveyor of this type in the world, we feel quite proud of this installation and would like to make all our Sales Engineers aware of it.

May I have your permission to print some of the information in your article in our company house organ "The Rex World"?

R. E. Kisch
Manager, Training & Advertising
Chain & Transmission Division
Chain Belt Company
Milwaukee, Wis.

● *Permission granted—Ed.*

A S Q C

I would like to get a copy of the issue in which you have the article on the Automotive Division of the American Society of Quality Control, which I believe was in the April 15th issue. How do I go about getting same?

Frances D. Huntington
F. D. Huntington Co.
Detroit, Mich.

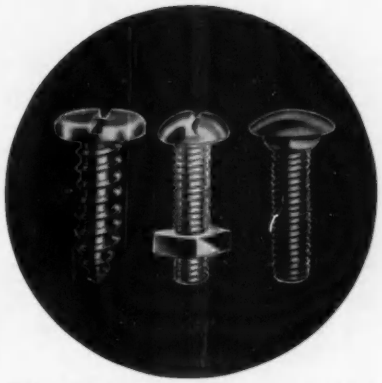
● *The issue was mailed promptly—Ed.*

MIGHTY MITE

This morning I received the first issue of my subscription to AUTOMOTIVE INDUSTRIES, and was pleased with the article on the "Mighty Mite" by Joe Geschelin.

Ralph C. Chestnutt
Cleveland, Ohio

STANDARDIZE 100% ON SOUTHERN FASTENERS



Today more cost-conscious management men are taking a new hard look at quality fasteners as a partial solution to production problems. These men know that faulty fasteners often take a big toll in profits because of rejects, downtime, waste or spoilage. Likewise, they know that quality fasteners help insure more profitable operations through elimination of needless production hazards.

It's good sense to standardize 100% on Southern fasteners for production and for profit. Southern specializes in standard fasteners for industry. All are USA-made in our own plant.

For super savings all along the line—your production line! — standardize 100% on Southern fasteners. Ask your nearest Southern distributor for your free copy of our new chart BP-2 describing Southern's new industry-approved bulk package and palletizing system, or write Southern Screw Company, P. O. Box 1360, Statesville, N. C.

Manufacturing and Main Stock in Statesville, North Carolina

WAREHOUSES:
New York • Chicago • Dallas • Los Angeles

Machine Screws & Nuts • Tapping Screws • Stove Bolts • Drive Screws • Carriage Bolts • Continuous Threaded Studs • Wood Screws

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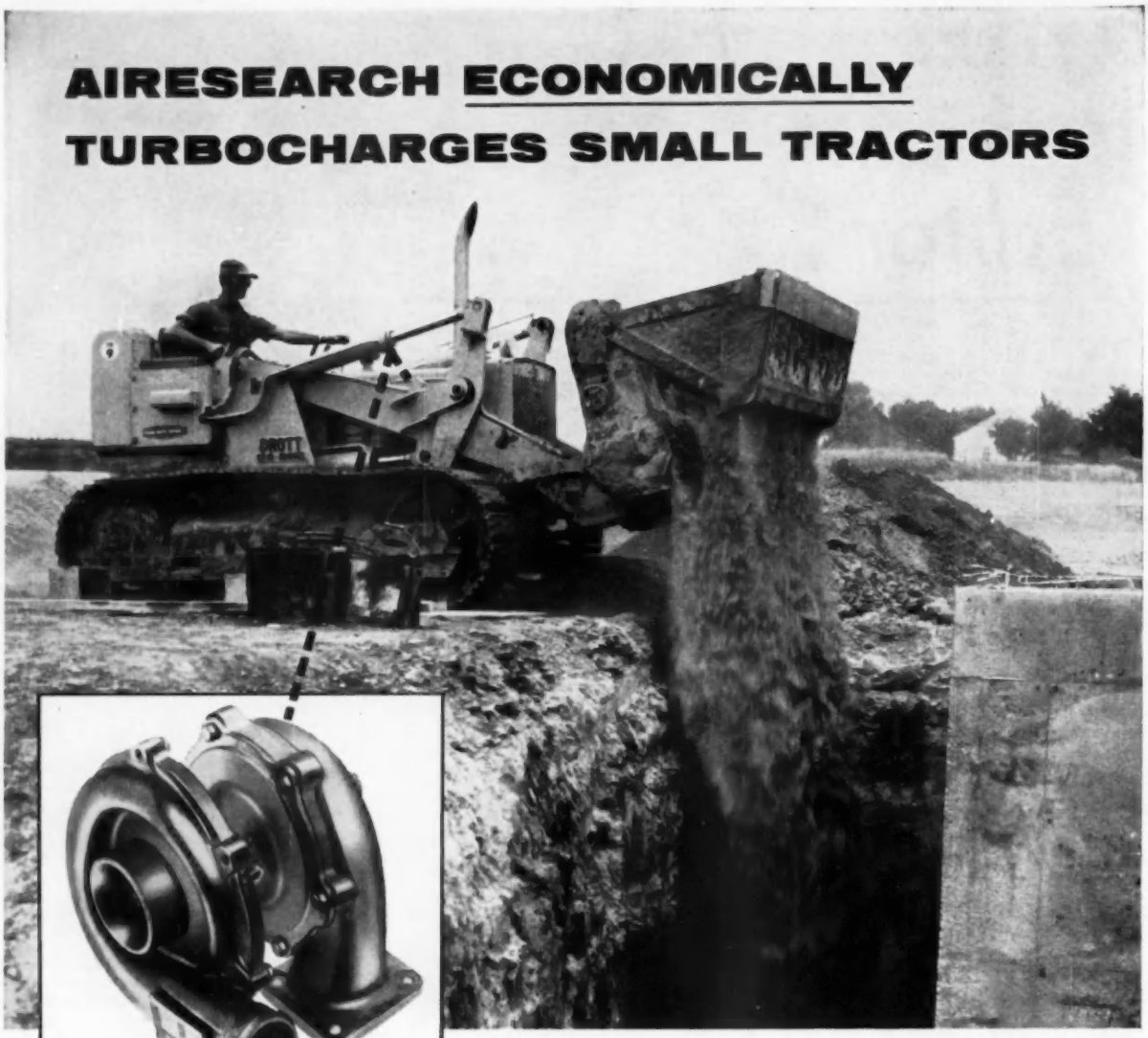
AIRESEARCH ECONOMICALLY TURBOCHARGES SMALL TRACTORS



AiResearch T-6 turbocharger

International Harvester's TD-9 shows 18 percent more torque rise

AiResearch's small T-6 turbocharger now enables the 282 cu. in. engine on International Harvester's new TD-9 crawler to develop a torque equal to a naturally aspirated engine 25 percent larger in displacement. This low cost turbocharger substantially reduces the unit cost of small tractors operating at this power level.

Boosting this small block engine to 71 horsepower and greatly increasing its versatility, the above pictured T-6 model also provides up to 10 percent better fuel economy.

Weighing 24 lbs. and measuring 7¾ in. in diameter, the T-6 is one in a complete line of AiResearch turbochargers which makes the turbocharging of small diesel engines economically desirable.

AiResearch is a world leader in the development and production of air-cooled turbochargers and turbocharger controls for all major diesel engine applications. Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

Circle 114 on Inquiry Card for more data

TROUBLE—FREE

SMOOTH—OPERATION

Manufacturers of the big diesel trucks, that must stand up under hour-after-hour of gruelling service, have learned to rely upon MECHANICS Roller Bearing UNIVERSAL JOINTS to deliver hundreds of thousands of miles of trouble-free service. Because MECHANICS JOINTS drive through KEYS—instead of bolts—they stand up under punishment that shears off other types of fasteners. They are designed with less parts and connections for easy assembly and servicing—smooth running balance—maximum strength with less weight—and long, trouble-free, safe operation. Rugged stamina is just one of the advantages you get when you specify MECHANICS Roller Bearing UNIVERSAL JOINTS. Let MECHANICS engineers help you design this and other competitive sales features into your product's transmission train.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner • 2024 Harrison Ave., Rockford, Ill.
Export Sales: Borg-Warner International
36 So. Wabash, Chicago 3, Illinois

MECHANICS
Roller Bearing BW
UNIVERSAL JOINTS
For Cars • Trucks • Busses and Industrial Equipment

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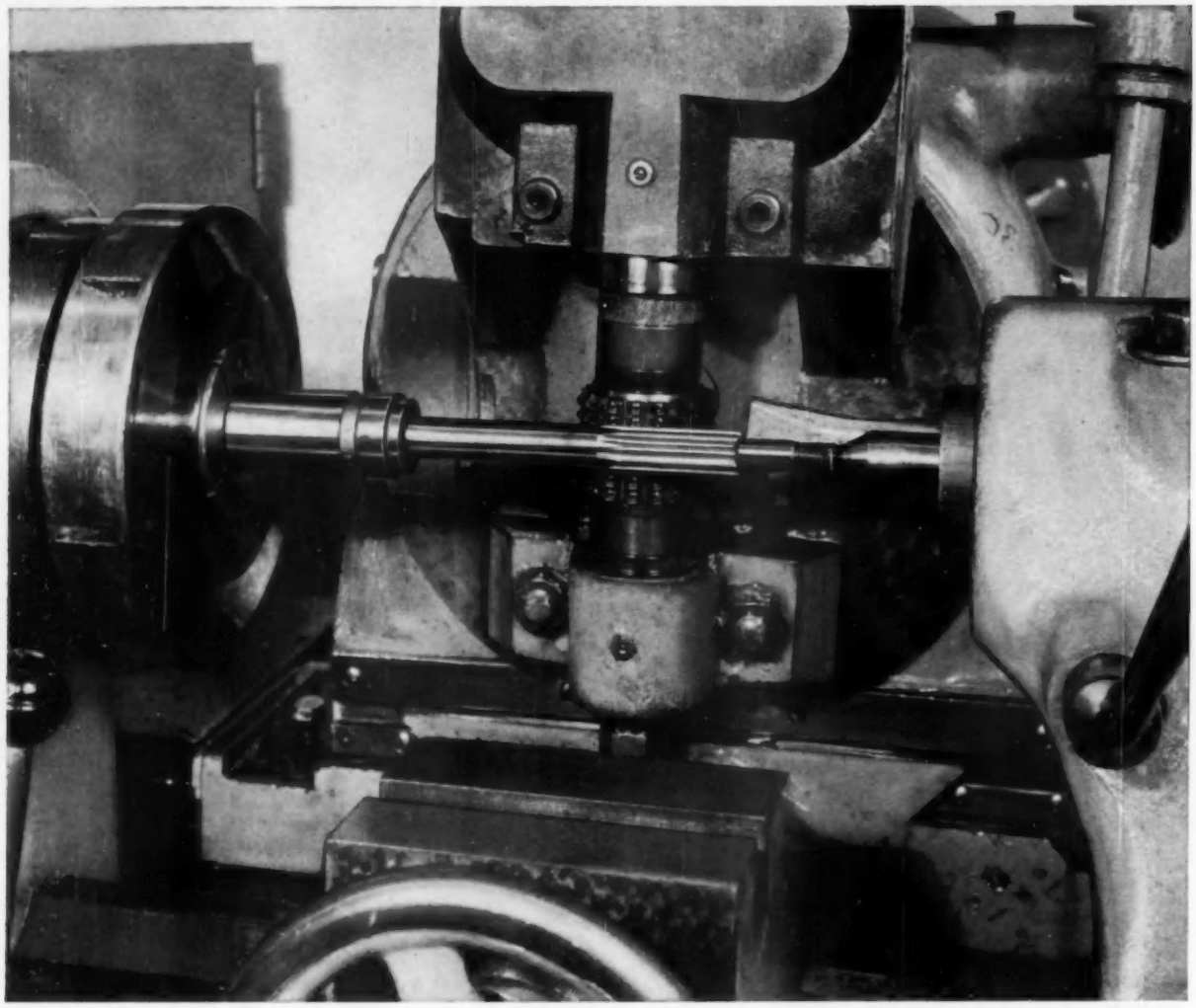


Photo courtesy Greenlee Bros. & Co.

Aristoloy Leaded Doubles Tool Life... Increases Feed 70% for Greenlee

ARISTOLOY STEELS

Two divisions of Greenlee Bros. & Co. switched to Aristoloy 4150 leaded. Faster machining—feeds and speeds boosted 60 to 70%—and improved surface finish were realized by the Machine Division on gears, spindles and shafts. Similar benefits were realized by the machine tool maker's Tool Division on machine bits, hydraulic rams, pistons and cylinders. Tool life was upped 200%, drastically reducing tool costs and eliminating hours of down-time for changes.

For complete information about free-machining Aristoloy leaded steels, call the Copperweld representative in your nearest large city. Write for booklet, "A Complete Line of Leaded Steels," or information on standard carbon, alloy and stainless grades.

COPPERWELD STEEL COMPANY

ARISTOLOY STEEL DIVISION • 4025 Mahoning Ave., Warren, Ohio • EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

Circle 116 on Inquiry Card for more data

NEWS

Vol. 122, No. 11 June 1, 1960

Compact Field Grows

GM Officially Announces 3 Small Models

By Hugh C. Quinn, Detroit Regional Editor and C. B. Campbell, News Editor

The compact car field is becoming less and less compact. General Motors has added three more names to the growing list of compacts, and next fall nearly half the domestic brands will be in this group.

GM's board chairman, Frederic G. Donner, announced officially what has been unofficial fact since before the Corvair—that Buick, Oldsmobile and Pontiac also will get into the act with small cars of their own. Donner told the annual meeting of GM stockholders last month in Wilmington, Del., that these divisions will introduce their new cars in the fall.

Name New Models

His announcement was followed by brief naming-giving notices from the three divisions. Buick will revive its one-time prestige name, "Special," Oldsmobile will stick to its numbering system with "F-85," and Pontiac will call its compact "Tempest."

The Tempest will be built in the division's main plant in Pontiac, Mich., with additional production probably added later at one of the B-O-P assembly plants. The F-85 will be built in Lansing and South Gate, Calif., while the Special will be built on a new assembly line in Flint.

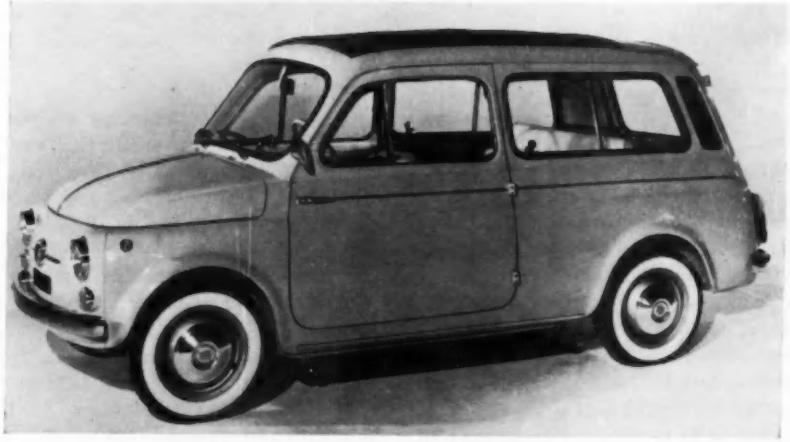
Edward D. Rollert, Buick general manager, said first-year production will be on two final assembly lines in adjoining buildings. The modernization plan at Flint eventually will provide for two parallel lines.

Pontiac will build its own engine —a cast iron, in-line four-cylinder engine slanted to 45 degrees. The Tempest will use an adaptation of Corvair's transaxle, although the Tempest engine will be front-mounted.

Buick will build the engine in Flint that both the Special and F-85 will use—an aluminum block V-8. The block, however, will come from Central Foundry Div.'s Defiance, O., plant.

Donner also confirmed at the

FIAT'S LATEST MODEL GIARDINIERA



Italian station wagon has novel flat air-cooled engine beneath the rear floor. It weighs 1224 lb and has a top speed of more than 60 mph.

NOW IT'S THE JUNIOR TRUCK

GMC Truck and Coach Div. of General Motors has introduced this special-purpose half-ton truck, the GMC Jr. van. Shorter than any American-made compact, it has 98 in. wheelbase and 243-cu ft. load area.

stockholders' meeting that Corvair will broaden its line with more body styles for 1961. He did not go into detail, but it is known that Corvair will offer a station wagon and a few compact trucks next fall.

With the three new GM compacts and the upcoming Dodge Lancer, there will be 10 U. S.-built small cars on the market next fall. Naturally, the competition in this part of the market will be cranked up to a high pitch. Some of the current compacts might suffer—and some might benefit from the added interest stirred up by fresh publicity, promotion and advertising dollars.

No one has said yet how many new compacts Buick, Oldsmobile and Pontiac expect to sell the first year, but there's a clue in the reported Buick forecast of 200,000 engines the first year. This would roughly break down to 100,000 each for Buick and Olds, plus another 100,000 for Pontiac.

The four new compacts for '61, then, could easily tot up half a million first-year sales—some of them new sales but some, undoubtedly, conquests from other makes of cars. Some sales no doubt will come from present ranks of Buick, Oldsmobile and Pontiac owners.

Ford to Make Own Thunderbird Bodies

With Thunderbird production rising rapidly, Ford Motor Co. will make its own T-Bird bodies in its Wixom, Mich., plant starting early in September.

Since 1954, the bodies were produced at the Budd Co.'s East Side plant in Detroit. At that time, the Thunderbird daily output was between 50 and 60 and it would not have paid Ford to tool up for such a small production. Now, however, T-Bird output is 440 daily and Ford officials apparently believe it will pay the company to make T-Bird bodies.

The Thunderbird will be assembled at Wixom. Stampings will be shipped there from the Metal Stamping Div. plants at Dearborn, Cleveland, Buffalo, N. Y., and Chicago Heights. Previously, Budd delivered the bodies to Wixom from its East Side factory in Detroit.

At the same time, Ford announced Budd would make all major stampings and some sub-assemblies for the 1961 all-new Lincoln. There has been talk of a 1961 model run of 40,000 Lincolns which will be smaller and lower priced. There will be only one model, but no decision has been reached yet on whether it will be a hardtop or convertible.

When the 1960 model run is completed, it is expected 100,000 T-Birds will have been built. This compares with a Lincoln output of about 30,000.

A Budd spokesman said Ford has placed new business with his firm for a portion of Ford's truck cab production and more major truck assemblies in addition to the Lincoln body business.

Kaiser, Lockheed Plan Argentine Plane Plant

The first aircraft manufacturing venture in South America by U. S. industry has been launched with establishment of a new plane manufacturing company in Argentina by Lockheed and Kaiser interests.

Aviones Lockheed-Kaiser Argentina, the new enterprise, will be an equal partnership of Industrias Kaiser Argentina, largest manufacturing company in that nation, and Lockheed Aircraft International, a Lockheed subsidiary.

Initial product will be the light, single-engine utility plane developed by Lockheed for use in Latin America. It also will be made in Mexico by Lockheed-Azcarate, another Lockheed affiliate, and in Italy by the newly formed Aeronautica Macchi-Lockheed partnership.

Traffic Rate Head

The Traffic Rate Committee of the Automobile Manufacturers Assoc. has elected as chairman Q. L. Perry, supervisor of Rate Research and Analysis, Chrysler Corp.

Ford Experts Develop Speedy Steel Process

Ford Motor Co. has developed a process for making open hearth steel in less than half the time required for conventional systems now in use. Irving A. Duffy, Ford vice president, says the new process, which is based on the use of burned lime and oxygen-fuel lances, cuts the time to three hours for one ton.

The Ford process, as the company prefers to call its new forced-draft ingot production, was announced by Henry Ford II at the annual shareholders' meeting May 19 in Detroit. He said this new development points up the "relentless pressure" to improve products and industrial processes in the automobile business.

Ford officials were careful to explain the new ingot process applies only to the final, open hearth stage of steel making, and therefore Ford's over-all steel capacity will not be affected. Despite the reduced time for making ingots, the preliminary steps—coke ovens, blast furnaces, ore handling, etc. —are not changed.

Mr. Duffy also pointed out that additional oxygen equipment at the Rouge steel mill will not be ready for general use for 18 months. He said Ford will continue to purchase about half its steel requirements from outside sources. Ford, with a current rated capacity of 1,950,000 tons a year, is the Nation's 13th largest steel producer.

Briefly, the new Ford process works like this: A basic charge of 50 per cent scrap and 50 per cent hot metal is used. Scrap is rapidly charged with a high firing rate, using oxygen fuel from both end burners and roof lances for higher heat imput. Burned lime is used instead of traditional limestone to speed up chemical and thermal reaction.

After the short, high-temperature charging period, hot metal is added for the purification process. The total time from charging to molten steel is three hours.

Metal Powder Use Increasing in Autos

Metal powder compacts are being used increasingly in the automotive industries because of their special properties and favorable costs industry spokesmen told the 1960 Powder Metallurgy Show in Chicago.

Powder metallurgy finds one of its largest uses in production of gears. Both spiral bevel and helical gears are being produced. Highly accurate gears and spacers also are being produced in both heat treated and untreated condition.

Helicopter Recovers Parachute Package

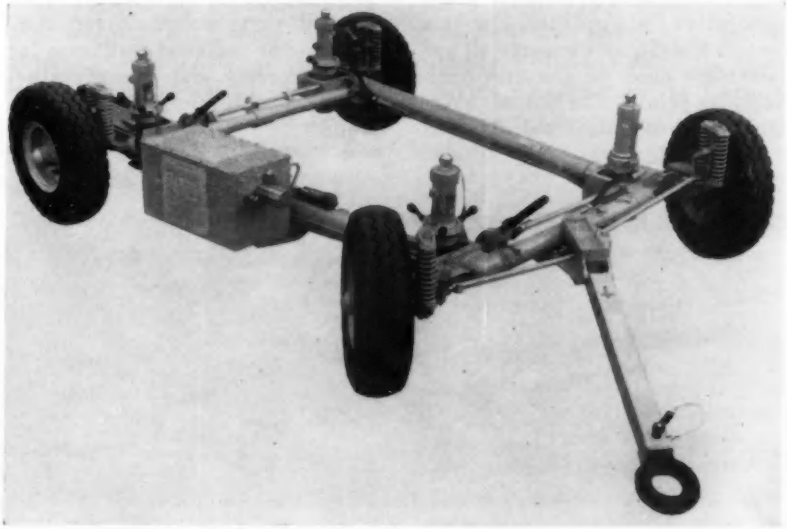
The first helicopter recovery of a package suspended from a descending parachute has been carried out over Sussex County Airport, Georgetown, Del., by a Sikorsky S-55 helicopter.

Army, Navy and Air Force officers who attended the tests said they opened new possibilities for the recovery intact of small target drone aircraft and guided reconnaissance missiles so they could be used again and again.

New Rootes Plant

A new Rootes Group assembly plant and service headquarters has been opened in Salisbury, Southern Rhodesia. The plant is equipped to assemble the entire Commer and Karrier line of buses and trucks from knocked down kits imported from England.

TRAILER FOR AIRBORNE SYSTEMS



Northrop Corp. has developed this lightweight component handling trailer to transport airborne systems and components weighing up to 3000 lb.

NEWS

CONTINUED

Zinc Industry Studies Welding Techniques

Expecting an increased use of galvanized steel in unitized body construction, the zinc industry is including a study of welding techniques for the coated steel as a major part of its research projects.

A joint meeting in St. Louis of the Lead Industries Association and American Zinc Institute was told by Schrade F. Radtke, Director of Research for the Zinc Institute, that if automotive manufacturers included zinc in underbody construction it would mean at least 100,000 tons of zinc added to the annual market.

Use of zinc-coated sheet steel for underpanels in unitized bodies is recommended by one manufacturer as a result of "an extensive evaluation of materials," Mr. Radtke said. "After investigating all coating systems, it was found that only galvanized steel would guarantee the desired life and at the same time accomplish this at low cost."

The problem that develops is that underbody panels are primarily structural members and any corrosion that seriously weakens them jeopardizes the structure. For this reason, Big Three compacts all use galvanized sheet or zinc-rich anticorrosive paints. The Corvair averages 40 lb of galvanized sheet in underbody panels and 20 lb of zinc in zinc-rich paint. The Falcon contains 85 lb of galvanized sheet and about 10 lb of zinc paints. The Valiant uses zinc chromates in paints.

Construction of 1961 models of Thunderbird, Lincoln, Buick, Oldsmobile and Pontiac will include galvanized steel members, the group was told.

Use of this coated steel on production lines means the problem of "dirty" electrodes must be solved. Sound welds can be produced with a fatigue life equivalent to that obtained with uncoated steel, but the electrode is subject to premature failure.

Some of the zinc volatized from the surface of the sheet steel seems to diffuse into the copper of the electrode's copper, causing a brittle brass to be formed, thus lowering the electrode's conductivity.

B-W Acquisition

Borg-Warner Corp. has acquired 25.4 per cent interest in Ralph McKay Limited, an Australian implement parts manufacturer. B-W will provide technical assistance for manufacturing and also for automating two McKay plants in Australia.

PRESSURIZED EXECUTIVE AIRCRAFT

The Marksman, new pressurized executive plane, has been announced by On Mark Engineering Co. It can cruise between 325 and 365 mph. It accommodates seven or eight passengers and pilot and co-pilot.

Parallel Bargaining By Big Three Likely

A labor relations expert has predicted that the Big Three will attempt parallel bargaining with the UAW again in 1961, when current labor contracts expire. William H. McPherson, professor of economics at the University of Illinois, made his prediction at the May meeting of the Industrial Relations Research Association in Detroit.

Prof. McPherson said the auto companies will have some plans for strike assistance when they enter bargaining next year, although the odds now are against a major auto strike in '61. One basis for his forecast of parallel bargaining, Prof. McPherson said, was the success the Big Three had with this new technique in 1958.

Meanwhile, the UAW is beginning to prepare for the siege of '61. The union's National Ford Council has laid out a plan for a series of regional meetings to plan the strategy for negotiations with Ford Motor Co. Resolutions passed at the Council's meeting in early May indicate that prices and employment practices may loom as major issues in contract talks.

Ramblers in Uruguay

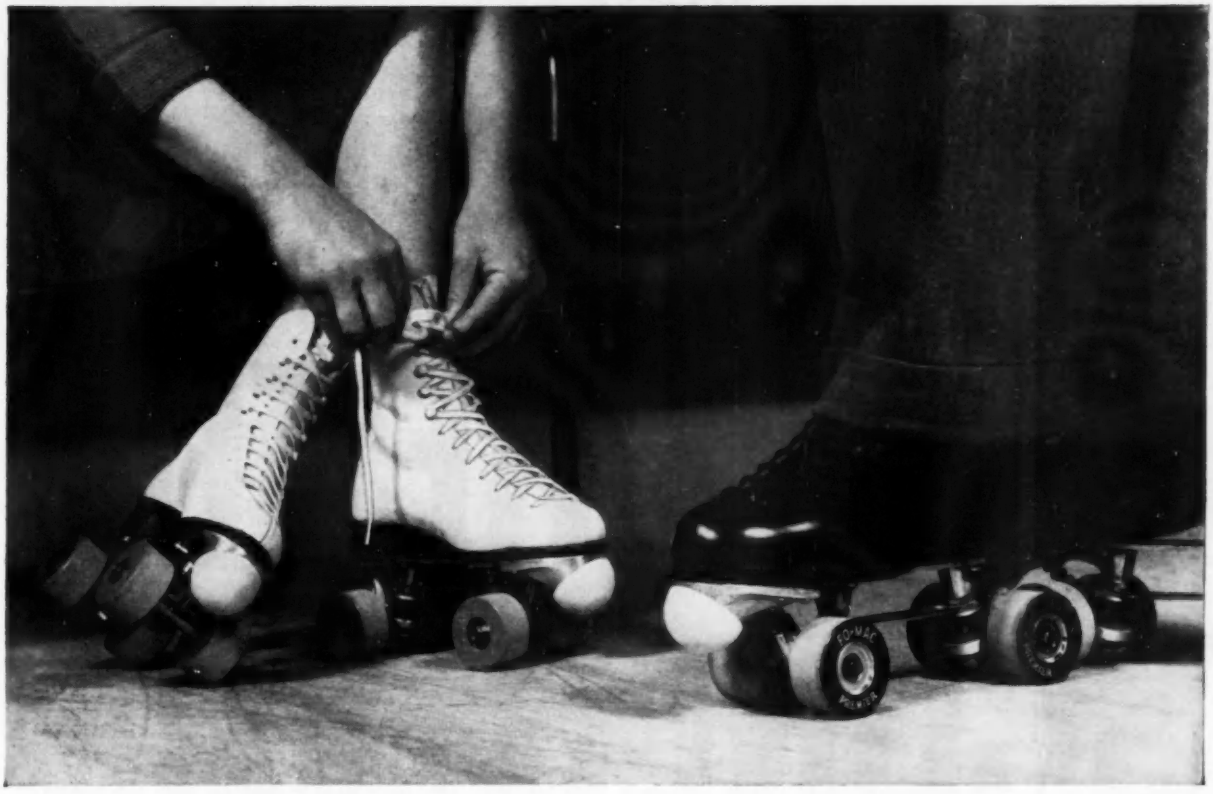
American Motors is making arrangements with a Montevideo, Uruguay, firm for the licensed assembly of Rambler cars in Uruguay. AMC will have no financial interest in the plant, but will supply components in knock-down form for assembly in the South American country at the initial rate of 1200 cars a year. This will be AMC's third overseas venture. It has similar licensees in Mexico and South Africa. A Canadian plant will begin operations this year.

Bell Gets Option

Nord-Aviation, S. A. of France has signed an agreement giving Bell Aircraft Corp. an option for the U. S. manufacturing rights of its supersonic CT-41 and subsonic CT-20 target missiles.

Another new development using

B.F.Goodrich Chemical *raw materials*



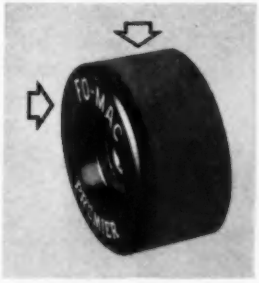
USING TWO HARDNESSES OF HYCAR

these skate wheels play a dual role

Hard on the outer edge for longer wear; softer on the inner edge for better traction, less noise. The two shades of color you see in these roller skate wheels show how two different Hycar nitrile rubber compounds are used to serve different needs in the same product.

The outer 3/16" of each wheel is a phenolic compound made with extra-tough Hycar rubber for better abrasion resistance. The inner portion of the wheel is made from a softer Hycar phenolic compound. The two are inseparably bonded during molding.

In addition to providing extra wear and other advantages, in other applications Hycar also provides excellent resistance to oils, chemicals, and gasoline. It is often the key to improving a product or opening a new market. For more information, write Dept. FL-3. B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



PREMIER *for professional skaters, and RENTAL, for rinks that rent out skates — wheels are made using two different Hycar nitrile rubber compounds by Fo-Mac Enterprises, Tulsa. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.*

Hycar
REG. U.S. PAT. OFF.
Rubber and Latex

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

**See our catalog in Sweet's Product Design File.*

B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

Circle 117 on Inquiry Card for more data

STROMBERG CARBURETOR SCORES AGAIN

IN MOBILGAS ECONOMY RUN

★ Wins Top 4 Positions in Class C ★

During the 1960 Mobilgas Economy Run, Stromberg® carburetors proved once again their superior ability in delivering maximum mileage.

In the low-price, 8-cylinder field (Class C), the first four cars were equipped with Stromberg carburetors: the first- and second-place Plymouth Belvederes, and the third- and fourth-place Dodge Darts.

Stromberg carburetors helped a Studebaker Hawk to first place and a Dodge Matador to second in the low-medium price group (Class D).

Stromberg carburetors *do* deliver more mileage. The 1960 Mobilgas Economy Run proved it again!

Bendix-Elmira
Eclipse Machine Division
Elmira, New York

THE Bendix CORPORATION

Circle 118 on Inquiry Card for more data

NEWS

FEATURES

Aluminum Favored Despite Corvair Shift

Corvair's running change last month from an aluminum to a cast iron manual transmission case started rumors in Detroit of a reversal in the trend to aluminum.

Reports from Ford and Chrysler might back up these rumors. But closer scrutiny reveals that aluminum is still very much alive and in favor at auto plants.

Corvair started out with a permanent mold case on the manual transmission. The running change to gray iron was made for a combination of reasons, including cost-reduction. But it is highly possible that Chevrolet eventually will switch back to aluminum when die-casting facilities permit.

Ford's small V-4 engine, at one stage in its planning, had aluminum specified for both block and head. As it now stands, the head will be aluminum but the block will be gray iron. Another new Ford engine, a V-8, was planned as an aluminum engine last year. Latest word on this engine is that it could be either iron or aluminum.

Chrysler is planning to produce 10,000 aluminum block slant sixes in the fall, reportedly for taxicab fleet testing. But there also is talk that Chrysler will change the intake manifold on this engine from the current aluminum to gray iron.

HIGHWAY AID FOR MOTORISTS

H. Leslie Hoffman, president of Hoffman Electronics Corp., demonstrates solar-powered transmitter for new emergency calling system for turnpikes and other congested or remote traffic areas. By pressing any of four buttons—for police, ambulance, fire truck, or service truck—a motorist can transmit a coded radio message for help.

Ford Offers to Buy Sherman Products

Ford Motor Co. has offered approximately $2.3 million for most of the assets of Sherman Products, Inc., of Royal Oak, Mich. Ford's Tractor and Implement Div. is Sherman's prime customer for power diggers, backhoes and industrial loaders for tractors, as well as two transmissions.

Sherman stockholders will vote June 24 on the proposal and also on a plan for dissolving the company. Ford plans to continue manufacturing the Sherman line of products.

Chandler Elected

James M. Chandler, Ford Motor Co., has been elected chairman, Vehicle Combustion Products Committee, Automobile Manufacturers Association.

AI TABLOID

Manufacturers in the motors and generators industry shipped products valued at $1394 million in 1958, a decrease of four per cent from 1954. Average employment in the industry showed a 16 per cent decrease to a total of 93.8 thousand employees.

* * *

Employing a stainless steel butterfly valve, a new braking system halts automotive vehicles by building up back pressure in the engine through closing off the exhaust line.

* * *

Shielding for protection from radiation in atomic powered ships employs polyethylene plastic containing boron in thick sections that are much lighter than customary shields of metal or concrete having equal effectiveness.

* * *

Solid propellant booster rocket motors can now be designed to be built in segments up to six ft in diameter that can be assembled to give multi-million lb thrust to motors.

* * *

A fallout alarm, depending on a penny size circuit including a pinhead size piece of cadmium sulfide, can be installed in the family radio or TV set to give a screaming warning of radioactive danger.

* * *

Five human engineering reports concerning effects of isolation, self-instructional devices, individual and group control systems, inter-member communication, and the trade-off of variables in decision making have been compiled for science and industry.

* * *

Savings in operating costs and lead time by using investment castings instead of machined castings for some small arms components are reported in an Army study just released. Another Army report describes the successful application of solid, granular particle coatings to investment casting molds by gas-solid fluidization.

Fuel tests in a small gas turbine (220 hp) were conducted recently by the Gulf Research and Development Co. to determine the effect of fuel properties on deposit and smoke problems. Deposit troubles were encountered with all No. 2 fuel oils tested, many of the 2-D diesel oils, and even some of the L-D diesel oils. Exhaust smoke usually was heaviest with fuels giving the most combustor deposits.

* * *

A "novel catalyst" that has proved highly successful in laboratory studies may provide an effective method for eliminating smog-producing hydrocarbons from motor vehicle exhaust gases. Produced by Arvin Industries, Inc., it is now being road tested.

* * *

Jet airliners designed to cruise at 2000 mph could be built for $11 million each, it has been estimated. They would be about the size of the present Boeing 707s and Douglas DC-8s. Similar craft twice as large would cost $20 million each, engineers estimate.

* * *

The substitution of nickel for part of the iron in a binder of tungsten carbides improves the strength and hardness of carbide compacts, a report from Army metallurgical experts reveals.

* * *

Techniques for determining and measuring the efficiency of magnetic pulse generators and signal generators is the subject of two technical reports offered for sale by the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce.

* * *

During 1958, manufacturers in the boat building and repairing industry shipped products valued at $320 million, an increase of 96 per cent over 1954. The number of workers jumped from 17 million to 24.6 million during the same period.

Lee O. Witzenburg, sales manager, Cleveland Worm & Gear and Farval Divs., Eaton Mfg. Co., has been elected president of the American Society of Lubrication Engineers.

Gasoline Is Used To Inflate Tires

Firestone Tire & Rubber Co. engineers and the Army Transportation Research Command are using gasoline to inflate pneumatic tires. More than five feet tall and three and a half feet wide, the tire has a capacity of 521 gal of fluid.

The armed forces are testing the new tire to speed fuel transport anywhere in the world. Two of the giant tires are mounted on an axle and tow bar assembly and are hitched to the back of a truck. One truck can pull a train of five "fuel trailers," more than 5000 gal of gasoline.

Air Pollution Post

Dr. E. M. Adams, of Dow Chemical Co., has been elected chairman of the Manufacturing Chemists' Association's Air Pollution Abatement Committee.

Next Decade's Auto? Simple and Roomier

What will our automobiles be like during the next decade? Nobody knows for sure, but Chevrolet's E. N. Cole has ventured this general prediction:

Styling will be simple and unadorned; annual model changes will not involve "massive and exotic" changes, but will consist generally of refinements to improve the product and give greater dollar value. Functionalism and thrift will be the theme of the 1960's.

Cars probably will be shorter, a little higher and much lighter, says Mr. Cole, and they will be easier to get into and out of, with more passenger room and trunk space.

Mr. Cole, who is general manager of Chevrolet and a vice president of General Motors, sees the automobile industry tailoring its products to fit changing needs during the coming 10 years. As an example of the "tailor-made" automotive product, he lists the possibility of new vehicles developed to suit the needs of new suburban living.

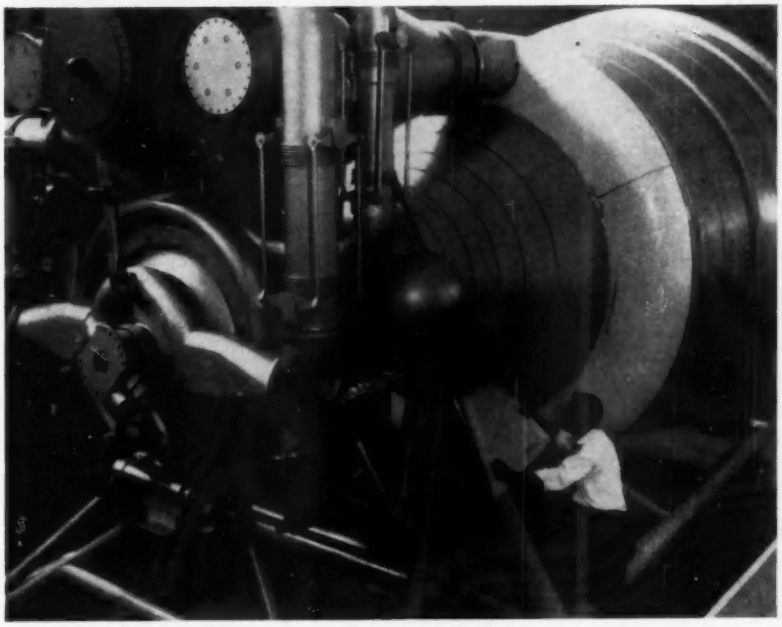
On propulsion, Mr. Cole predicts that the conventional piston engine will be the automobile power plant during the next 10 years.

Allison to Develop Nuclear Power Plant

The Allison Div of General Motors is one of two contractors selected by the Atomic Energy Commission to design and develop a compact nuclear power plant for military applications.

Allison and the Nuclear Development Corp. of America are working jointly on a mobile, lightweight power plant with a rating of 2000 to 3000 kilowatts.

MOCK-UP OF MOST POWERFUL ROCKET ENGINE



When it is ready for flight in four years, America's most powerful rocket engine will look much like this full scale mock-up. Under development by Rocketdyne, a division of North American Aviation, Inc., for the National Aeronautics and Space Administration, the single chamber engine is designed to produce 1,500,000 lbs of thrust, more than triple today's highest thrust.

Budd Will Study Galvanized Welding

A new research project aimed at development of an economical process for production-line welding of galvanized steel—of major importance to the automotive industry—has been announced by Dr. Schrade F. Radtke, director of American Zinc Institute's expanded research program.

The research will be conducted by the Budd Co. under the auspices of the zinc institute. Principal areas of investigation will be electrodes, welding techniques, and characteristics of galvanized sheets. The objective is to develop techniques and associated accessories which will permit production welding at the same rate and on a similar maintenance basis presently employed by the automotive industry in welding uncoated steel strip.

Galvanized steel welded into unitized bodies is fast becoming an important basis of current auto design and resolution of existing problems promises a new market potential of some 100,000 tons of zinc used for galvanizing by auto makers.

2,200,000th Compressor

Bendix-Westinghouse Automotive Air Brake Co. has turned out its 2,200,000th compressor for truck and bus air brake systems at its plant in Elyria, O.

NAVY BOMBER TESTS TRACTOR

The A3J Vigilante, fastest Navy bomber, is undergoing ground tests with the new TD-80 "Paymover" towing tractor at Glenview Naval Air Station, Glenview, Ill. The diesel-powered tractor, only 36 in high, develops more than 8000 lb drawbar pull. It is available with or without gas turbine compressor.

Observation 'Copter Sought by Army

The Army has asked development of a light observation helicopter to replace three aircraft now in service. Industry has been invited to design the new 'copter which eventually will replace the L-19 observation plane, the H-13 and H-23 reconnaissance helicopters.

The new helicopter project is part of a long-range Army aviation program drafted by a special Army Aircraft Requirements Review Board. The program calls for studies to begin this year on technical problems connected with the development of deep penetration surveillance aircraft and transport aircraft for use within a battle area.

Two different designs for the new helicopter will be selected for development as a result of the industry competition. Testing of the two designs is expected to be held in 1963 and will provide the basis for selecting the final design. Production is expected to begin in 1964 or 1965.

The new helicopter will be powered by a turbine engine instead of the reciprocating piston engine presently used in most aircraft. It will be lighter and smaller than the H-13. It will cruise at 126 mph, operate for a minimum of three hours without landing, and have a payload of 400 lbs., plus the pilot and three hours' fuel.

Army Has System For Land Navigation

The Army Corps of Engineers has disclosed a land navigation system has been developed that keeps vehicles on course when traveling over poorly defined or unmapped areas such as the Arctic, deserts or jungles.

Developed by Army Engineers and the Chicago Div. of American Bosch Arma Corp., the land navigation system consists of four lightweight units that provide constant heading and position information. Direction to the home base, as well as distance and direction to the destination are available on demand.

The units include a gyro-compass, analog computer, a distance data transmitter and a power supply. They have a combined weight of only 85 lb.

Tests have shown the system has an accuracy of one-half of one per cent or 1/200th of the distance traveled. Service tests are expected to be completed next year.

Goodyear Schedules $90 Million Expansion

A world-wide capital expenditure program of $90,000,000, the largest in the company's 61-year history, has been planned by Goodyear Tire & Rubber Co. in 1960, E. J. Thomas, chairman of the board, has announced.

The 1960 investment plan exceeds the company's 1959 expenditures by nearly $35 million and brings the company's 1955-1960 capital investment total, including 1960 authorized, to $440,000,000.

"We feel that these undertakings, unequalled in the rubber industry, constitute clear-cut evidence of our faith in the year ahead," Mr. Thomas declared. "As in the past," he said, "Goodyear will make these investments to keep up with increased customer demands for its present products and to provide for new ones."

The 1960 capital expenditure program will touch almost every phase of the company's diverse activities, some 40 per cent of which are now in fields other than tires. An active participant in the missile development race, Goodyear is deeply engaged in such areas as rocketry, electronics and guidance systems.

Increase Predicted In Auto Financing

The next decade will find more of us going into debt to buy new cars, with automobile credit pushing beyond the $25 billion-a-year mark by 1970.

Alan G. Rude, president of Universal C.I.T. Credit Corp., says that at least four out of five new car purchases will be financed by the end of the decade, compared with the current rate of seven out of 10. Auto installment credit during that period should increase more than $8 billion, according to Mr. Rude.

Expert Discusses Aluminum Alloys

Use of aluminum in the automotive industry, already increasing in volume, may be further increased through special methods of treating aluminum casting alloys, according to Dr. Kurt Schneider, president of Aluminum Ltd.'s subsidiary in Nuremberg, Germany.

Speaking at the American Foundrymen's Society's "Casting Congress and Exposition" in Philadelphia, Dr. Schneider pointed out that properties of aluminum casting alloys could be improved by controlling their content of minor constitutents while influencing their crystalline structure. Desirable structures can be achieved by making additions of carbon tetrachloride as well as by controlling the cooling conditions during solidification, he added.

Dr. Schneider reported "To effect the formation of fine-grained crystals in aluminum-magnesium alloys containing 2 to 8.5 per cent magnesium, they are treated with carbon tetrachloride which is introduced into the melt by means of nitrogen as carrier gas. Small amounts of titanium (0.2 per cent maximum) and boron (about 0.0005 per cent) must, however, be present in the aluminum-magnesium alloys."

Compared to coarse-grained alloys, Dr. Schneider said, these grain refined alloys have improved mechanical and physical properties. It is possible to obtain 10 to 15 per cent better tensile strength, 25 per cent better elongation and substantially improved machinability. The grain-refining treatment has an especially favorable effect on tensile strength at high temperature, the speaker declared.

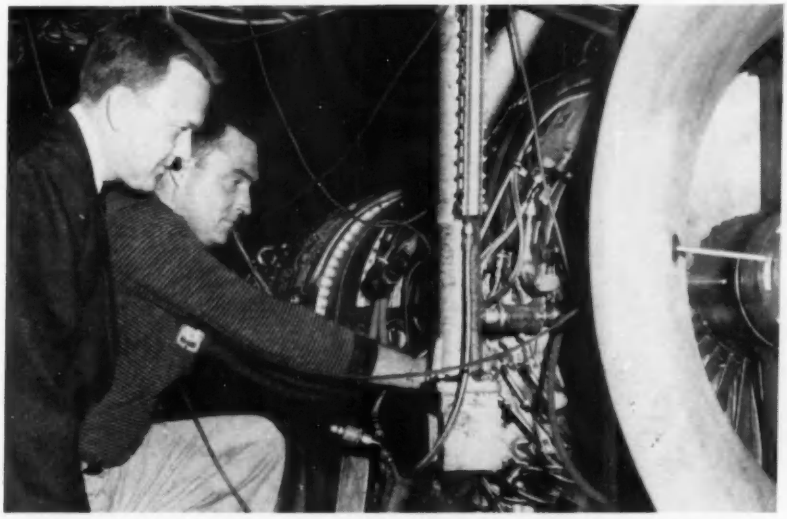
"As aluminum-magnesium alloys are preferably used for making cylinder heads for air-cooled internal combustion engines, the increase in tensile strength at elevated temperatures obtained by grain refinement is of special importance.

"In fact, for engines subjected to very high thermal stresses the use of aluminum-magnesium alloys for cylinder heads became possible only when the tensile strength at high temperature was improved by this grain refining treatment," he concluded.

In another address, James M. Smith, head of the engine section of the Aluminum Co. of America, declared at least 120 million lb of aluminum castings will be required for compact auto engines during the 1961 model year, more than double the 1960 usage.

Mr. Smith detailed three common casting methods for aluminum engines, with emphasis on advantages and requirements for economical manufacture. The three methods are sand casting, permanent mold, and die casting.

CHECK TURBOJET FOR REICH



First of 66 General Electric J79-7 turbojets to be installed in West German F-104 Super Starfighters is checked after completing test cell operations.

VTOL Plane Flown By Curtiss-Wright

A new Curtiss-Wright vertical take-off plane has been flown after nine months of engineering and airport testing.

Roy T. Hurley, Curtiss-Wright president, said the plane, utilizing two new radial lift propellers, was tested at 5000 ft. The transition to horizontal flight was made at this height and the craft flew at 165 mph.

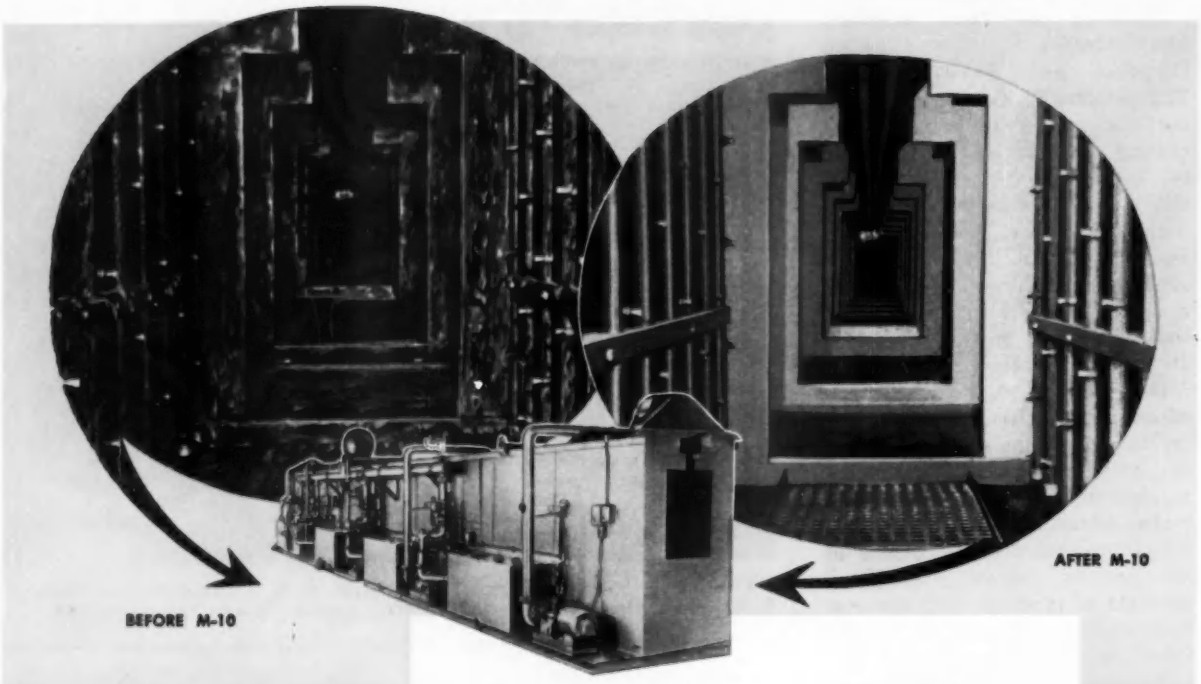
Curtiss-Wright also is completing fabrication of a six-place executive plane which will utilize four radial lift propellers, rise vertically to 16,000 ft and have a cruising speed of 400 mph.

ASTM to Hear Editor

Joseph Geschelin, Detroit Editor, Chilton Publications, will present a paper on cutting fluids at a symposium during the annual meeting of ASTM in Atlantic City during the week of June 26. The paper will urge establishment of machinery for conducting a nation-wide survey of cutting fluid practices.

DETREX M-10

Miracle Phosphate Scale & Sludge Remover



- Prolong equipment life
- Eliminate acid damage to equipment
- Clean all "inaccessible parts"
- No dismantling of equipment necessary
- One material operation — less labor
- No neutralizing necessary — just rinse

Here, at last, is the answer to the phosphate coating industry's maintenance problem. Phosphate scale, hard water scale and insoluble salts can be quickly removed from pipes—inside and out—and from walls and coils within the phosphate zone.

Detrex M-10, an alkaline cleaner, efficiently dissolves scale and sludge without damaging the equipment in any way. It may be used in immersion or spray equipment to greatly reduce the man-hours formerly required. With Detrex M-10 you completely eliminate the hazards inherent with the use of acid chemicals.

Send today for complete information on the new miracle phosphate scale and sludge remover — Detrex M-10.

DETREX CHEMICAL INDUSTRIES, INC.

Box 501, Dept. AI-660, Detroit 32, Michigan

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MEN IN THE NEWS

Wagner Electric Corp.—Carl E. Widell has been appointed vice president-marketing.

Ohio Crankshaft Co., Crankshaft and Camshaft Div.—A. H. Schott, general manager, has been named a vice president.

McCord Corp., Equipment Gasket Div.—Ray A. Altalo has been named sales manager.

Chrysler Corp., Chrysler and Imperial Div.—W. G. Beasley has been appointed advertising manager.

Fruehauf Trailer Co.—Walter C. Kavanaugh has been named product sales manager.

Electric Storage Battery Co., Automotive Div.—William A. Healy (far left) has been named vice president-manufacturing, and James F. Macholl (near left) has been named vice president-engineering.

Borg-Warner Corp. — **Franklin Sloff** has been elected assistant controller.

Ford Motor Co., Ford Div.—**D. J. Bracken** has been appointed general manufacturing manager.

Firestone Tire & Rubber Co. — **George D. Hitler** has been named sales manager of private brand tires.

Republic Steel Corp., Union Drawn Steel Div.—**William A. Carter** has been appointed service chief.

United Aircraft Corp., Sikorsky Div.—**James W. Clyne** has been named manager of sales and service.

La Salle Steel Co.—**Warren J. Trifiro** has been named Southwest sales representative.

International Harvester Co. — **Marshall M. Parkhurst** has been appointed general traffic manager.

Electric Autolite Co.—**Robert O. Floren** has been appointed marketing manager for aviation batteries.

Ford Motor Co.—**Milton E. Smith** has been named assistant manager of the Buffalo stamping plant.

General Electric Co., Small Aircraft Engine Dept.—**Martin C. Hemsworth** has been named engineering manager.

Clark Equipment Co.—**Elmer J. Dunham,** credited with designing the first mass-produced industrial forklift truck, has retired.

Eaton Mfg. Co., Reliance Div.—**Ronald A. Patt** has been promoted to manager-Springtite Sales and Service Dept.

Allis-Chalmers Mfg. Co.—**Robert L. Halsted** has been named manager, Milwaukee district.

American Motors Corp.—**George R. Browder** and **A. E. Tracy** have been promoted to assistant sales managers.

Clark Equipment Co., Central Parts Div.—**John J. Mlynski** has been named Chicago plant manager.

General Motors Corp., United Motors Service Div.—**Harold P. Schaller** has been appointed general sales manager.

Midland-Ross Corp. — **William H. Dickinson** has been named general manager, Owosso Div., and **David E. Walbert** has been promoted to group vice president in charge of Owosso, Ross Engineering, Waldron-Hartig and Ross Engineering of Canada Ltd., Divs.

Eaton Mfg. Co., Reliance Div.—**John L. Knott** has been appointed sales engineer.

Allis-Chalmers Mfg. Co.—**J. D. Greensward** has been elected president, Canadian Allis-Chalmers Ltd.

International Nickel Co., Primary Nickel Dept.—**Robert E. Savage** has been named foundry industry manager.

Ford Motor Co.—**Raymond J. Fitzgerald** has been named Production Control Dept. manager at Buffalo stamping plant.

Aerojet-General Corp.—**B. A. Kvist** has been appointed director of contracts.

Enjay Co., Inc.—**Albert H. Pflugh** has been named assistant manager of Mid-Atlantic District.

Necrology

Glen A. Bassett, 72, former president of Gar Wood Industries, Inc., died May 6 in Miami, Fla.

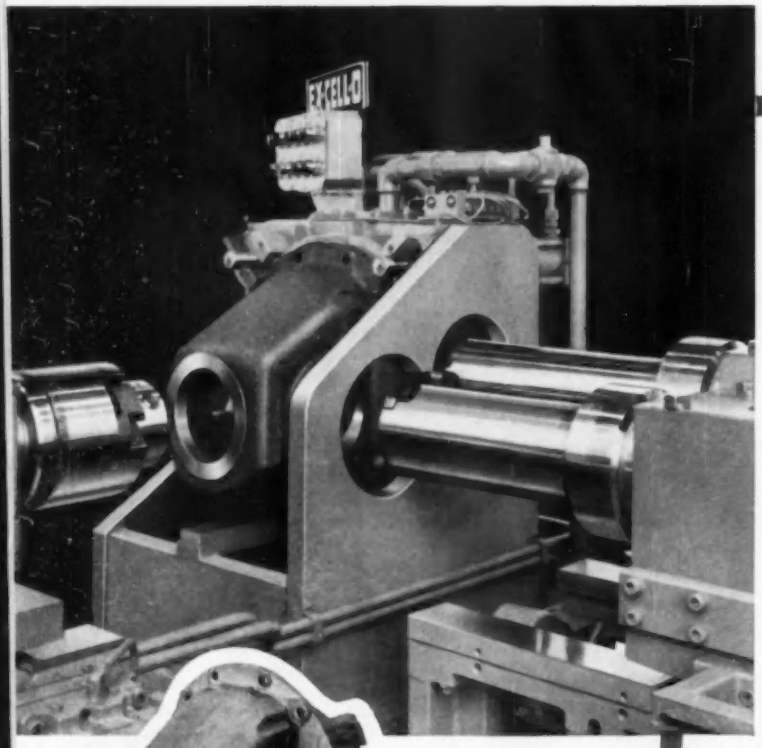
William R. Moore, 69, former Norton Co. vice president, died in Clearwater, Fla.

Virgil J. McKendry, 51, chief engineer for the National Induction Heating Co., died May 9 in Detroit. Previously, he had been a member of Chrysler Corp.'s engineering research department for 10 years.

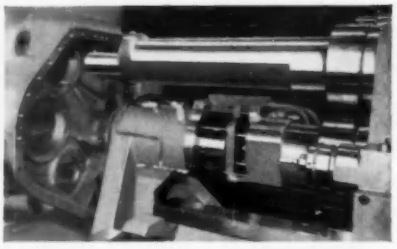
Cameron W. Ryckman, 68, retired parts specialist for the Detroit Ordnance Tank Automotive Center, died April 28 in Detroit.

Henry N. Falls, 61, died May 3 in Miami, Fla., while vacationing. He was maintenance supervisor of the Lincoln-Mercury Div., Ford Motor Co.

Ex-Cell-O Custom Machines Specialize in Difficult Jobs!

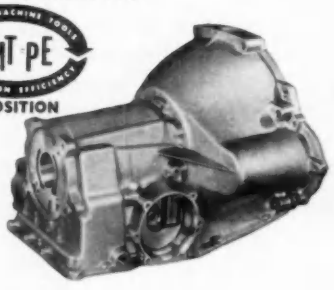


HEAVY-DUTY BORING—Custom Boring Machine uses three heavy-duty Ex-Cell-O Precision Spindles to simultaneously finish-bore four holes and bore-and-face a fifth hole in this 75-pound cast-iron housing in a 4½ minute cycle. Diameters are about 6"; tolerances are held within .001".



MULTI-DIAMETER BORING—In a single cycle, the long boring bar on this Custom Machine line-bores two holes while shorter bar below it bores a third diameter, and small spindle in foreground bores a dowel hole in this huge clutch and gear housing.

SEE EX-CELL-O'S BOOTH 946, NMTBA EXPOSITION



HIGH PRODUCTION—Aluminum transmission case shown above is turned 90°, rolled over 180° as it passes through a 24-station Custom Machine. Automatic operations include precision boring, facing, chamfering, radial milling, tapping, trepanning, air gaging and flushing. Output is 124 parts per hour.

Whether you have a simple job that must be done faster and more accurately, or complex work that requires multiple machining operations, an Ex-Cell-O Custom Machine may be just the answer you've been looking for . . . the economical solution to a difficult production problem.

See your Ex-Cell-O Representative, or contact Ex-Cell-O's Machinery Division in Detroit for details on the limitless applications of Ex-Cell-O Custom Machines.

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • RAILROAD PINS AND BUSHINGS • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-31

Circle 120 on Inquiry Card for more data

Technological Humanism

an Editorial

At The Dedication Of The General Motors Technical Center in 1956, Dr. Lawrence R. Hafsted, Vice President and Director of the GM Research Staff, introduced a concept which was described as "technological humanism." The essence of this concept is the idea that all scientific advances might well appear with more widespread contemplation, understanding and wisdom. He said, in part, that "our potential market is large enough to permit manufacturing operations on such a large scale that costs can be reduced by a really significant amount. This cost saving, which we call 'Technological Gain' is of such magnitude that under our system it has been sufficient to provide both additional 'purchasing power' to the consumer and additional 'incentive' for more production."

This System, Which Amounts to a virtual "chain reaction"—it was pointed out, remains sustained as a virtual prime mover of progress, not only for the automotive industry, but also for all others which share in automotive production. Among the industries which share these advances, are the machine tool builders. Other such industries include the producers of materials. Dr. Hafsted further stressed that "in the never-ending quest for lower-cost and better performance in all of our divisions, the physical properties of available materials are utilized to their very limits."

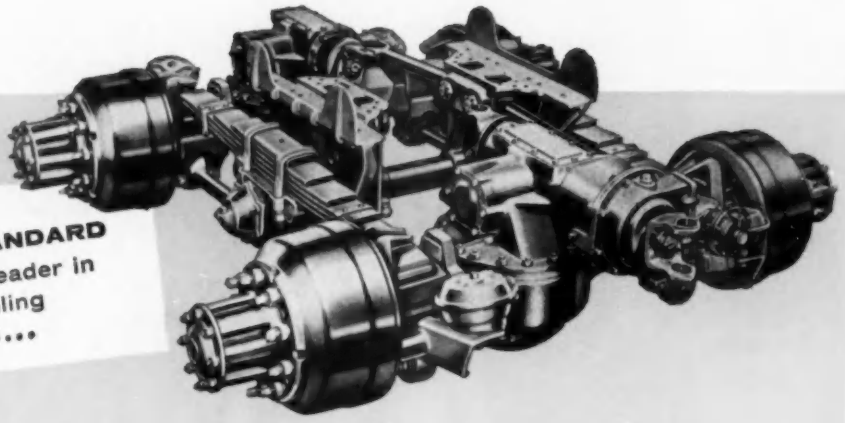
In Fulfilling The Goals of Using both materials and machines to their "very limits," it is natural that the automotive industry seeks to share with others, to their mutual benefit, the technical and engineering advances which have appeared.

It Is At This Point That this continuing quest and search for improvement and innovation enters a stage of inter-action with other industries. It is in the higher interest of both the automotive industries and the supplier industries, that such efforts occur as a function responding to incentives, rather than as one responding to lesser kinds of motivation. Since the motivation for improvement of a machine tool is as real to a machine tool builder as it is to the automotive plant user, both share a common and important objective. This simple and constructive aim can enable the automotive plants to obtain more and better machine tool equipment. And it can also enable the machine tool builders to incorporate advances in their machine tool designs.

Other Spokesmen For The Automotive Industries have also envisaged the gains of the future as objectives which can be attained through cooperation with other major industries. In all probability, automotive leaders would be the executives least likely to encourage the use of compulsion or arbitrary action, as a substitute for the processes of consultation and joint research and development in connection with problems of supplier corporations. Just as the automotive industries want to keep open the channels for free competitive action for themselves in the future, there can be little doubt that they want this same principle to apply to all of their actions, policies and methods, in their relationships with all other major fields of manufacturing. The resulting competition, freely activated and freely continued, will bring the maximum benefit to automotive manufacturing. Certainly every automotive industry engineer, designer, buyer and manufacturer wants free and open access to the best of choices of the old and tested ideas, machines, materials and processes, as well as to the best, and most likely to succeed, of all of the new ideas in these fields. That is "Technological Humanism" in action.

Hartley W Barclay

Editor and Publisher



ROCKWELL-STANDARD
Acknowledged Leader in Rugged Hauling Operations...

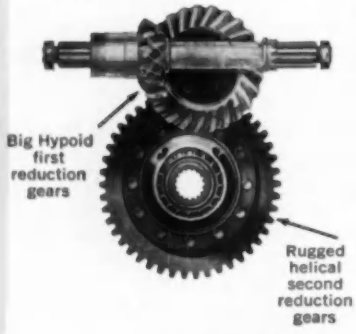
Here's why Timken-Detroit®

DOUBLE-REDUCTION TANDEMS LEAD IN TOP PERFORMANCE—LONG LIFE!

Timken-Detroit Heavy-Duty Tandems with Hypoid Helical Double-Reduction Gears are the big favorites for top performance and long life.
Here are some of the reasons why:

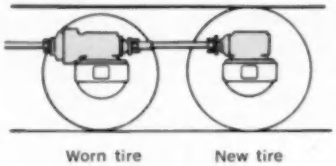
Rugged Hypoid-Helical Double-Reduction Gearing!

Balanced gearing—with two full-sized gear sets working in series to take an equal share of the load—provides a stronger power train with balanced gear set loadings and the widest range of ratios.



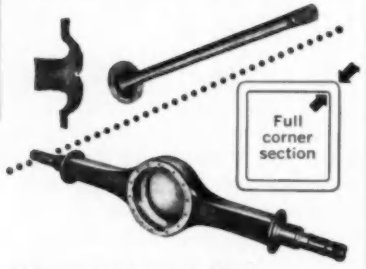
Driver Controlled Interaxle Differential!

Allows differential action between the axles to compensate for worn or mismatched tires. Both axles do equal amounts of work . . . can be disengaged at any speed, giving positive through drive when better traction is needed. *Straight-Line Through Drive* eliminates prop shaft angularity . . . increases bearing and gear life, reduces maintenance.



"Torsion-Flow" Axle Shafts and Hot-Forged Housings!

More splines, Torsion-Flow forging, and patented heat-treating processes make Rockwell-Standard shafts the toughest in the industry. Housings are hot-forged from high carbon steel, and are rectangular shaped with full strength corners for greatest strength with minimum weight.



Timken-Detroit Double-Reduction Tandems come in a wide range of capacities—6 models from 34,000 to 65,000 pounds.

Another Product of... **ROCKWELL-STANDARD CORPORATION**

Transmission and Axle Division, Detroit 32, Michigan

Circle 121 on Inquiry Card for more data

Vehicle Design Developments by Army-Industry Teams

An Exclusive Interview with

Brig. Gen. Chester W. Clark, USA

Ass't. Chief of Ordnance for Research & Development

TOPICS

- Powered Wheel Drives
- Aluminum Armor
- Fuel Cell Research
- Transistorized Ignition
- Compact Car Influence
- Eight-Wheel Vehicles
- Honeycomb Body Design
- Powered Semi-Trailers
- High Strength Steels
- Ride- and-Motion Studies
- All-Season Coolants

ADVANCES in the mobility of the United States Army have been so extensive since June, 1959, that it has become important for industry to have an overall view of such progress. To provide this view, a question and answer interview-type feature was obtained for AI readers. General Clark has been Assistant Chief of Ordnance for Research and Development since January 5, 1959. Major assignments earlier in his career have included service as Director of Research and Development at Picatinny Arsenal, Dover, N. J., and Deputy G-4 of the 8th Army in Korea during 1954-55. His achievements, after graduating from the University of California with a B.S. in 1927 and a Masters Degree in 1929, included obtaining a Ph.D. in Physics in 1935 from the University of Leyden in Netherlands. The significant responses to important questions are contained in the following pages.

Questions and Answers

Question 1—What is the significance of the "mobility" concept of the Army today? Why is it important?

Answer:—A high degree of mobility is necessary if the Army is to make maximum use of combat power. It is important because of our global commitments and the possible local numerical superiority of potential enemies under certain situations. Firepower without the necessary mobility is only part of the answer.

Question 2—Has the development of the American compact cars generated any technical or engineering design interest in the vehicular engineers in the Army?

Answer:—It has to some extent. Of course, the Army has always been interested in compactness as demonstrated by such early developments as a small aluminum amphibious cargo carrier in 1922, the bantam (which became the jeep), the special light jeeps, the Fletcher Flair, all of which preceded the present compact car which, of course, is not new, even to industry. Early examples include the Star, Durant, Whippet, American Austin, Erskine, Crosley, and even the Model T. The compact car merely represents the breaking of a stereotype—the automobile which had become the standard car in America. The Henry J and Rambler were tested by Ordnance about 1959. The new compact cars make available new modern engines, transmissions, and suspensions applicable to small light weight military vehicles. Vehicle developments can take advantage of the economies possible through the use of high production low cost components offered in the new compact cars. Further commercial developments being carried on in these areas will definitely be of interest for application to military vehicles, because much of this activity is of joint interest.

Question 3—What new developments have occurred in the development of off-highway types of heavy duty vehicles?

Answer:—The development of an eight-wheel vehicle should be of interest for civilian use where vehicles operate mainly over highways with the need for part-time off-road operation, such as cement mixer vehicles encounter. These vehicles exert low ground pressure and improve mobility without interfering with the size or shape of the cargo compartment or platform.

Perhaps of greater significance is the development of large tired floating four-wheeled vehicles called GOERS. These use articulated steering similar to that used in earth-moving equipment such as scrapers.

Development of improved types of rear wheel drives for the GOER vehicle is of interest to the earth-moving industry. Many of their vehicles operate at present with front wheel drive only. In addition, powered semi-trailers being developed could be on interest.

The development of military features for operation in arctic and tropic areas at extremes of low and high temperatures includes many features of interest to civilian operators in oil fields, the Northland and similar areas. This is a broad field of development including materials and lubricants functioning properly at these temperatures, with application of mobility and other features for movement over desert and arctic terrain.

Question 4—What advances have been made in development of self-propelled Ordnance equipment?

Answer:—The advances made in self-propelled Ordnance equipment, in the category of combat vehicles, are in the areas of both mobility and firepower. Our newer designs have also been made smaller, more durable and more economical in production, training, operation and maintenance. Specifically, in the heavier Ordnance equipment, compression ignition engines (Diesel) are replacing gasoline engines, the new flat track and suspension systems are lighter and simplified. A number of new materials and alloys and new uses for materials were recently tested for the first time. High strength steels can be folded into shape (eliminating welding) and light metals become effective armor plate for certain applications. The Army-Industry research team is continuing its investigations leading to such advances.

Question 5—How are the individual examples of vehicular improvements and advances tied-in to the concept of "total mobility"—and also to the concepts of tactical mobility, strategic mobility and logistics mobility?

Answer:—When our vehicles are made lighter and more compact, we have improved the transportability of the vehicles by land, sea or air. When the vehicles are given improved land locomotion capabilities, and this is added to improved transportability, the total mobility is definitely enhanced. Tactical mobility is improved not only by providing the vehicles better land locomotion capabilities, but also by increasing the fire power of weapons of given size and weight. In addition, we are designing a number of our vehicles so that they can float and are able to negotiate inland waterways at low speeds. Strategic mobility as pertains to rapid movement of large units, is improved through vehicle design primarily in the areas of better transportability and reduced total weight. Logistics mobility of vehicles is improved by Dieselizing our vehicle fleet, thus reducing the great tonnages of fuel required to support our Army vehicles.

Question 6—What new and unique design features of vehicles have been developed which are interesting to civilian vehicle design engineers?

Answer:—There are many areas of mutual design interest between military and civilian automotive engineers. In addition to those previously men-

tioned, the following developments are not unique to the military but have at least been stimulated by military requirements.

a. Use of compression-ignition or Diesel engines of modern, lightweight, high-speed automotive design, with effort to broaden their appetite for a wide range of fuels, including gasoline.
b. Improvement of vehicle durability and reduction of maintenance support. Emphasis is being placed on greater standardization of parts, elimination of items requiring frequent lubrication, ease of servicing and removal and replacement of assemblies, development of economical "throw-away" replacement parts to reduce repair in the field, improvement of corrosion resistance, and built-in durability for all elements of the vehicle.
c. The low profile tires that were developed for military use to replace duals are finding application in the commercial field. These tires are to provide better mobility, lighter weight, more load capability, and more stability as well as lower vehicle silhouette and resulting side cargo loading capability. These tires include 16-20, 14-20, 14-18, and 11.25-15. These new designs include interchangeable wheel and rim assemblies in the conventional sizes for both tube and tubeless tires. Designs which will increase fuel economy through reduction of tire rolling resistance are also being studied.
d. Development of semi-locking differentials, hydraulic transmissions and drives for larger vehicles. Also ride-and-motion studies for wheeled vehicles are being conducted to provide ultimately better equipment.
e. Military developments to improve the temperature tolerance, durability and efficiency of materials are significant. All-season coolants, preservative brake and hydraulic fluids, preservatives, fuels, and batteries are items actively involved. In addition, ozone resistant treatments for rubber products through chemical compounding, and the use of more durable enamels and lacquers have been developed and are in the process of being adopted by industry.

Question 7—What nonclassified Research and Development programs on vehicles or vehicle-related subjects are being carried on in Army establishments such as Aberdeen Proving Ground (including Detroit Arsenal)?

Answer:—In addition to those already mentioned, Research and Development programs which are being carried on include:

a. The XM521, 2½-ton truck of very lightweight design and honeycomb body structure.
b. The Truck, 5-ton, QUAD-TRAC, which is expected to offer outstanding mobility by application of tracks to an articulated steering, 8x8 type vehicle.
c. The lightweight, 1-Ton Marten, tracked, seven-man carrier.
d. The Supermarten, 1½-Ton, lightweight carrier is also being researched. These Marten vehicles are expected to provide extraordinary lightweight design and versatility.
e. Four-ton powered-wheel vehicle developments are being started. These may be of electrical, hydraulic, pneumatic, or mechanical types or any combination thereof. Greater design latitude in the building of this vehicle is expected from the application of these powered wheels.

Question 8—What developments (non-classified) have occurred in metals and alloys used on military vehicles, i.e., aluminum wheels or armor plate, corrosion-resistant components, etc.?

Answer:—Since mobility and equipment weight are directly interrelated, development and use of lightweight materials is one of the direct methods being employed to solve the problem. The materials which demonstrate the most promise of immediate economic feasibility are the alloys of magnesium and aluminum. The result is that there is now in the Army system an aluminum armored personnel carrier (M113). Our new tank, the M60, uses aluminum in its road wheels, top deck and fuel tanks. The T195 and T196 self-propelled artillery pieces employ aluminum armor. Magnesium has found use in the wheels of the M151 Jeep and in an air drop platform. The above applications are just the beginning. Work is continuing to exploit the advantages of lightweight materials on future vehicles across the board. In addition to reductions in weight, the use of lightweight materials sometimes actually increases the structural rigidity of the vehicles by permitting the use of thicker, but lighter members. The lightweight materials under consideration (alloys of aluminum, magnesium, titanium, etc.) also have the advantage of possessing a high degree of resistance to corrosion which is of paramount importance to the field maintenance problem.

Question 9—What stage of development has been reached in design and manufacture of the "hovercraft" or "levipad" type of air supported ground operated vehicle?

Answer:—The "hovercraft" or "levipad" are types of air-supported vehicles on which the Transportation Corps has done the main Army investigative effort. The scope of Ordnance Corps activity in the area of ground effects principles has been to conduct applied research studies toward using air-cushion phenomenon of the peripheral jet as a means of enhancing cross-country mobility of military vehicles.

Question 10—What advances can be revealed concerning "fuel cells" and "electric drives?"

Answer:—Fuel cells, whereby petroleum fuel in a readily available form, is in chemical cells for direct conversion of chemical energy to electricity, offers efficiencies about double that of our most efficient Diesel engines. However, at present the largest problems remaining in this area are how to get the equipment weight and size down to about that of current engines, and how to convert the commonly available petroleum fuels to the form of fuel re-

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Continental Develops NEW Multifuel Diesel Engine

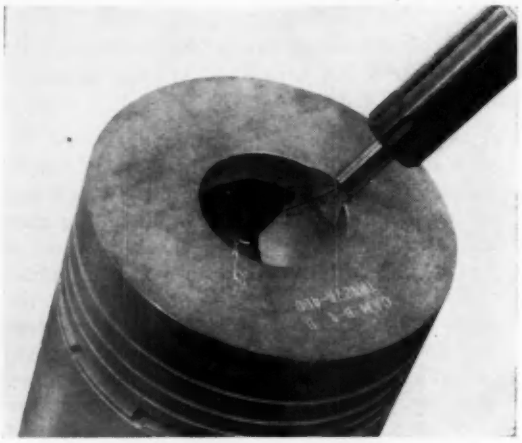

Fig. 1—Close-up of spherical combustion chamber in the dome of the multi-fuel engine piston. Note that the fuel nozzle is oriented so as to spray a thin film of liquid fuel over the surface of the chamber.

By Joseph Geschelin

DETROIT EDITOR

FOLLOWING an extensive period of field testing of its LDS-427 Hypercycle engine in the hands of troops, Continental Aviation and Engineering Corp. has provided us with complete details of the new engine, developed under contracts from Ordnance (OTAC). Essentially a four-stroke, overhead valve Diesel engine, LDS-427 is characterized as a "multifuel" engine, capable of burning any of the fuels usually available in U. S. military field depots, in particular all grades of Diesel fuel, JP-4 fuel, kerosene, and gasoline of 83/91 octane rating. What is most important is that all such fuels can be employed without making any changes or adjustments in the engine.

As a matter of background, it may be noted that the basic combustion principle employed in this engine stems from the M-combustion system of the M-A-N "hush" or "whisper" engine. The M-A-N engine was described and illustrated in an article by P. H. Schweitzer which appeared in AUTOMOTIVE INDUSTRIES, August 15, 1954.

Two major features of the combustion chamber are essential to the unique characteristics of this engine. The first is the geometry of the combustion chamber in the head of the piston; the other is a rotary motion that is imparted to the air stream induced in the same direction as the fuel jets. The rpm of the air swirl is increased considerably when its diameter is reduced at the top dead center. In practice, the rpm of the air swirl is selected for a specific engine—LDS-427 in this instance—to some value of N x crankshaft rpm.

Figure 1 shows the combustion chamber in an LDS-427 engine piston with the fuel nozzle arranged to spray fuel on the wall in the form of a very thin film. Direction of the jets is tangential to the direction of the air stream in the cylinder to reduce to the minimum the mixing of liquid fuel with heated air. Under these conditions vaporization of the liquid fuel takes place in the presence of very little air at low temperature, with gradual pre-oxidation as well as rapid mixture of fuel vaporization per unit of time, in conjunction with properly timed fuel injection.

Figure 2, a cross-section through two cylinders, shows the combustion chamber of the No. 5 cylinder. This is a spherical cavity in the piston head, and is cooled by an oil squirt on the crankcase side. The No. 6 cylinder shows a section of the swirl intake port. This is an essential part of the combustion principle, although the section does not show the essential detail. Briefly, in the LDS-427 design the intake port has a special core of helix configuration to provide the desired air swirl. The actual geometry of the intake port is developed in experimental single-cylinder engines to achieve exactly the desired characteristics.

Not only is the resulting engine capable of burning the variety of fuels listed earlier, but the combustion process is without the common

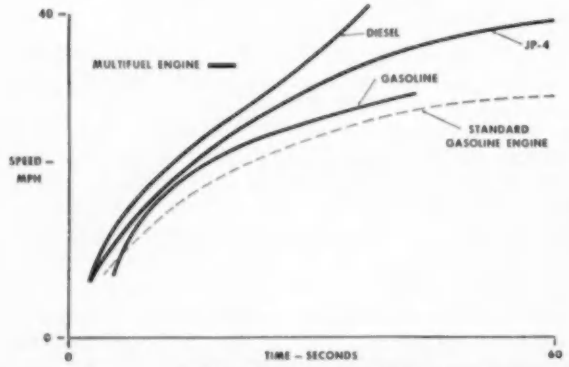

Fig. 4—Results of military acceleration and hill climb tests.

Diesel combustion noise sometimes called "cackle." Exhaustive tests have shown that no harmful deposits occur from operation on the various fuels; although certain types of gasoline having high sulfur content in combination with normal lead content cause deposits to form in the turbocharger. Fuel consumption in the multifuel engine vehicle is about 45 per cent less than that of the comparable spark-ignition engine vehicle and that advantage has been verified by many "side by side" tests in all climates. The multifuel engine vehicle also showed better acceleration, some test results being shown in Fig. 3.

The acceleration test noted above gives an interesting comparison of the performance of the multifuel engine and a standard gasoline engine in comparable military vehicles. It will be seen that the multifuel engine behaves better than the gasoline engine on gasoline; and appreciably better with other fuels. Decreased performance of JP-4 and gasoline compared with Diesel fuel is due in part to the lower Btu/lb of fuel content of the JP-4 and gasolines, and to inherent characteristics of the injection pump.

The LDS-427 engine seen in Fig. 4 is a 6-cylinder, inline, liquid-cooled, compression-ignition engine rated 140-Bhp at 2600 rpm. It may be noted that for military purposes engine output has been de-rated: i.e., it is capable of considerably higher output if desired.

An exhaust driven Schwitzer turbocharger of latest type is employed to achieve high specific performance. A thermostatically-controlled, bypass-type coolant system also includes a heat exchanger for both warmup and cooling of engine oil. The engine is equipped with American Bosch fuel injection equipment of distributor type, suitably modified to handle gasoline without attendant difficulty. Cranking is by means of a 24-volt starting motor. One of the important accessories supplied on this engine is an induction air heater. Used only for cold starts, it has its own spark plug.

The engine has a bore of 4.31 in., stroke of 4.87 in., displacement of 427 cu inch. With compression ratio of 22 to 1, it produces a torque of 330-lb ft at 1800 rpm. Valves are of overhead type, two per cylinder, actuated by a single camshaft.

The cylinder block is of cast iron with two interchangeable cast iron

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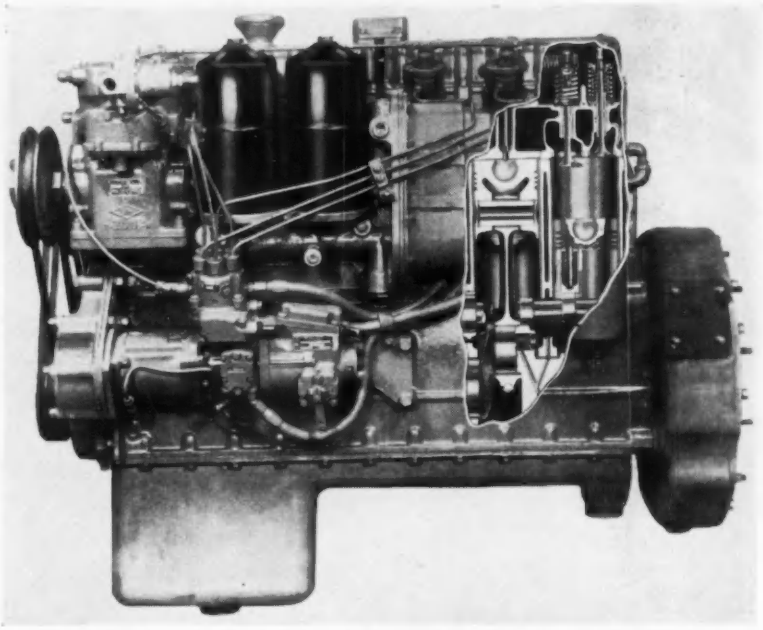

Fig. 2—LH side of multi-fuel engine with two cylinders in cross-section. Number 5 cylinder shows the geometry of the fuel cell as well as the cavtiy below the cell. Oil is sprayed on the surface of the cavity to cool the combustion chamber. Number 6 cylinder shows the intake valve port which is designed to produce a high speed swirl in the air stream. Mounted to the crankcase is the American Bosch fuel injection system. At the top is the Bendix-Westinghouse air compresser.

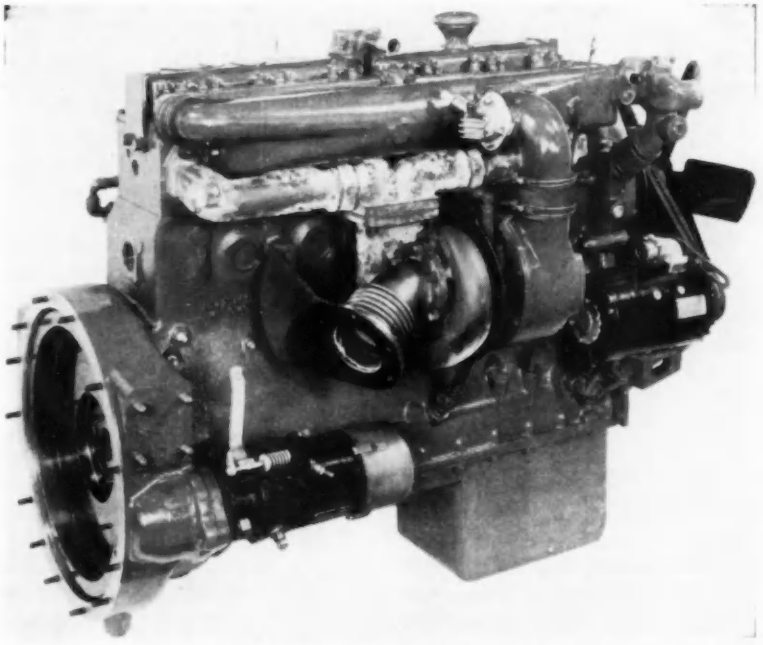

Fig. 3—RH side of the engine, showing the Schwitzer turbocharger; the induction air heater on the elbow above; the aluminum water manifold header; starter and generator.

Valves Forged at High Rate in Automatic Equipment at CHEVROLET

By Herbert Chase

PART I

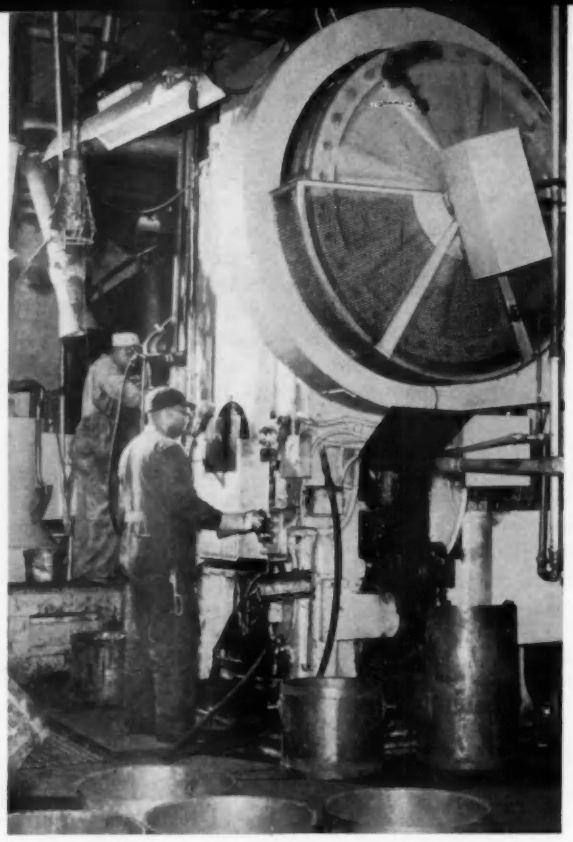

Fig. 1—Setup of one 700-ton Maxipress that does automatic forging of Chevrolet valves at 31 per min rate, using a two-impression hopper fed die equipped with transfer fingers and knockout pins. Forgings drop into tote tub at lower right.

PRODUCTION of inlet and exhaust valves for six- and eight-cylinder engines is among major operations at the No. 5 Plant of Chevrolet Division, G M C, Flint, Mich. These valves are forged at high rates in a battery of heavy presses, one of which, a 700-ton National Maxipress, is shown in operation in Fig. 1.

As output in very high volume is required, press setups are arranged to operate continuously and produce one valve at each working stroke, necessitating automatic feed of small heated billets supplied via a magazine at each press. In fact, the entire valve production setup is highly mechanized, not only to minimize manual operations but to enable equipment to maintain the high output required.

Seven slightly different valves are produced, but they all are similar in size and general design and made in the same equipment with tooling altered only slightly to suit each particular design. Exhaust valves are made from 1-in. bar stock of Armco No. 21-4N steel and inlet valves from GM No. 8440 bar stock of $1\frac{1}{8}$-in. dia. Billets are sheared to precise length so as to hold their weight within $\pm$ 3 grams and thus insure substantially uniform volume. Length is varied slightly, however, to suit the particular valve in production, four different lengths in all being used.

Bar stock to be sheared to length is fed automatically from a rack and into rolls that advance each bar through a Tocco induction heater on its way to the shearing knives in a 60-ton Bliss press that runs continuously and cuts one billet at each working stroke, or about 107 a minute. Heating is done at such a rate that the end of the bar reaching the shear is at approximately 1700 F. As each cut is completed, the billet falls via a chute into a tote tub in which cooling occurs before tumbling.

Although induction heating of the bar results in minimum scale,

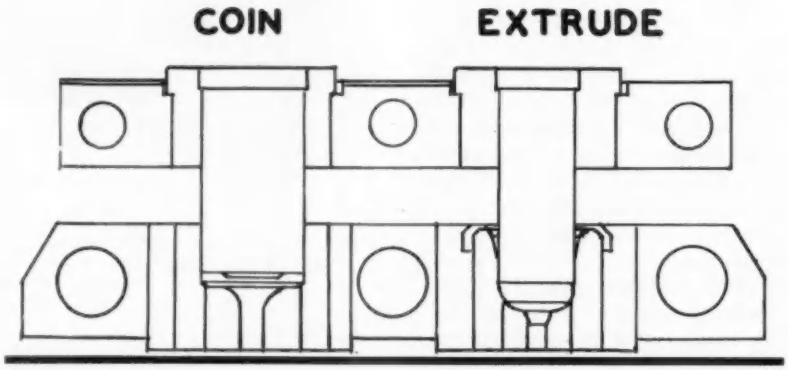

Fig. 4—Drawing of the forging die equipped with two removable cavity blocks. The first receives a shot of graphited oil before the billet is struck by the punch and the valve stem is extruded through the bottom hole. Die shown is for V-8 inlet valves. The die for exhaust valves is practically the same.

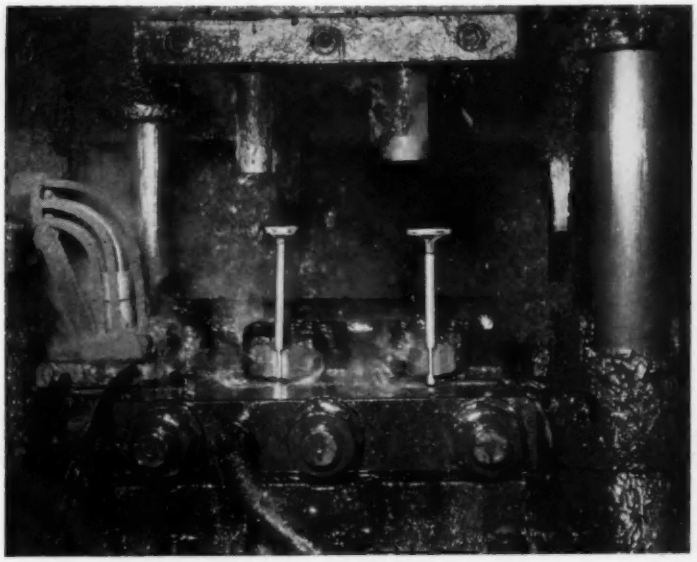

Fig. 2—Front view of the two-cavity die that is fed automatically with hot billets via the magazine at left. Forgings held by transfer fingers have just been elevated by knockouts at first and second positions and finished forging, right, is about to be dropped into a discharge chute.

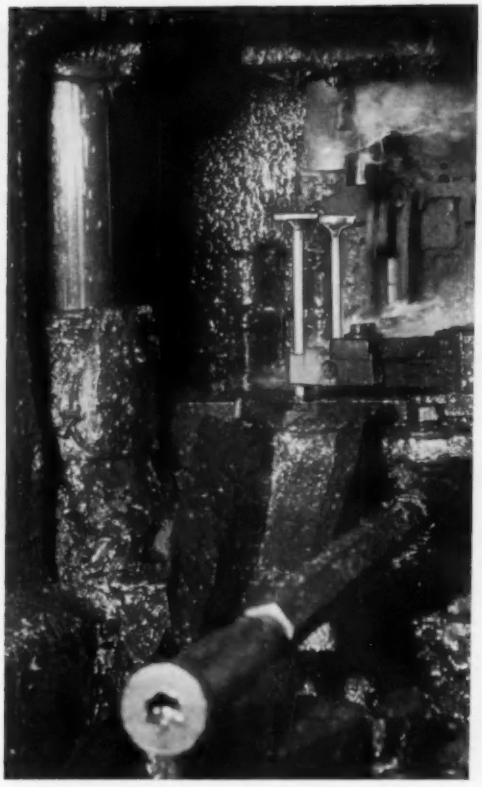

Fig. 3—Looking from the right side of the press into the open forging die, with loading magazine in background. Farther forging is about to be dropped into the second cavity and nearer one into the discharge chute, center foreground.

some is formed then and during subsequent cooling. This scale is slight, but is removed by tumbling before reheating for forging so that the billets will reach forging dies as nearly free of scale as conditions permit, the billets being bright as they enter the Tocco high frequency heaters, one of which is set as close as possible to each forging die. Some portions of the induction heating units appear in the background of Fig. 1 but the tube in which heat is applied is not visible in this view, as the tube with its induction coil projects through an opening in the side frame of the press to the left of the operator.

Billets are fed to the heater from a hopper and, after passing through the heater at a controlled rate suited to press speed, are discharged at 1750 F, one at a time. They fall into a short magazine made from bars that curve through 90 deg and drop each billet with axis vertical above the shuttle slide that feeds the forging die, as shown in Fig. 2. This illustration, taken with front guards of transparent plastic removed for photographing only, also shows two valve forgings gripped by transfer fingers.

As the press makes 31 working strokes a minute and produces one finished forging at each stroke, billets remain in the magazine only a very short time and so undergo only slight cooling. If troubles make it necessary to stop the press, however, long enough to cause billets in the magazine to cool below proper forging temperature, the operator opens a gate that discharges the billets into a chute next to the magazine, and they slide into a tote tub. They are replaced by hot billets from the heater as soon as the press is restarted.

Operation of the press is controlled by buttons at the operator's right hand but it normally runs continuously, unless the stop button is pressed, and one billet is fed to the first forging position by a slide before each working stroke. There is, of course, a die in each of the two forging positions. Each die is an insert fastened in a holder. The first cavity is tapered but the second has a cylindrical top opening that fits the mating punch.

Before the first die closes, it receives a shot of heavy fluid lubricant containing graphite. This is forced into the cavity by a pump actuated by the press. Such lubrication is important because all of the metal forming the stem of the valve has to be extruded through a central hole in the bottom of the die and, without suitable lubrication, wear would be prohibitive. Besides extruding the stem, the first die shapes the under side of the head but leaves its upper portion nearly cylindrical and close to billet size though much thinner than the axial length of the billet, as much of the total volume of metal is extruded to form the stem.

During the up stroke of the punch, a pushout pin below the die elevates the forging, pushing it between transfer fingers that close upon and grip the stem as its lower end clears the die. Thereupon, the fingers shift the forging to a position above the axis of the second die and, at the proper time, release the partly formd forging into this die. Fingers then retract to clear before the second punch, lowered at the same time as the first one, forces the forging into the finish forging die.

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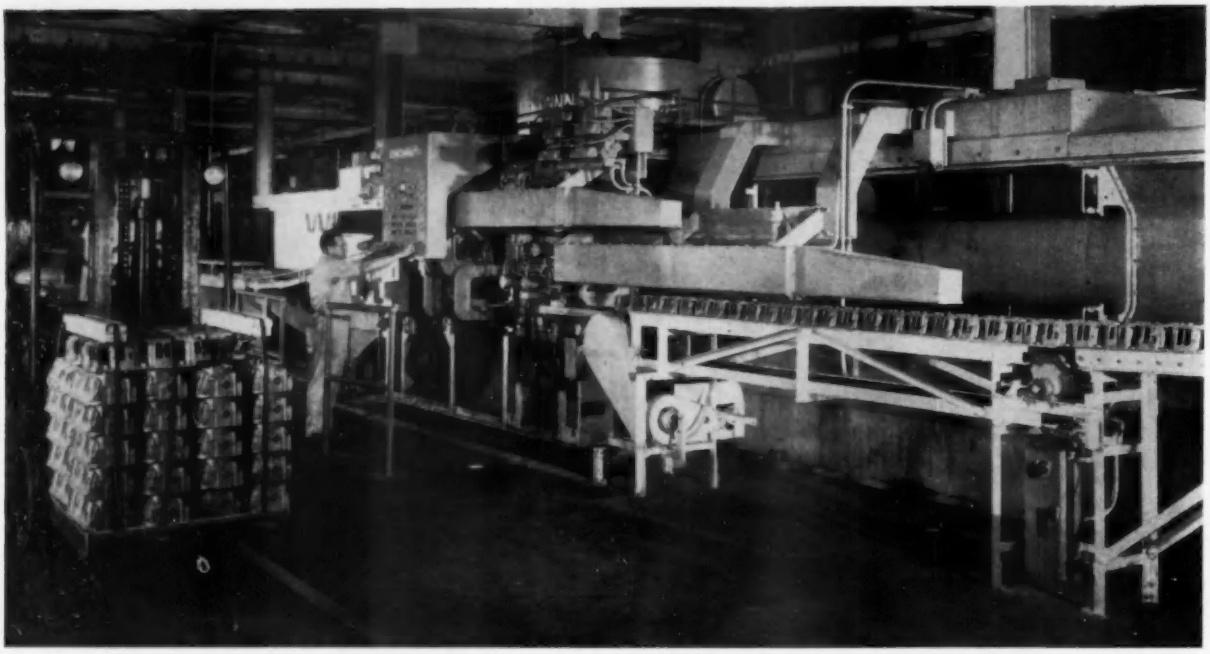


View of large Cincinnati horizontal surface broaching machine set up for broaching cylinder heads.

OPERATIONS ON CYLINDER HEAD LINE

Interchangeable Parts Facilitate Production of V-6 and V-12 Engines

This is the second installment of the study dealing with the manufacture of the new line of V-6 and V-12 engines at GMC Truck & Coach Division. The first article (see AI, May 15, 1960) covered highlights of cylinder block machining; this one is concerned with the machining of cylinder heads and crankshafts.

By Joseph Geschelin
DETROIT EDITOR

PART II

CYLINDER HEAD MACHINE LINE

THE CYLINDER head machine line is the only one in the layout arranged in a single straight line. It consists of the familiar, large horizontal Cincinnati surface broaching machine of three-station type; and an arrangement of three large Greenlee transfer machines. At the end of the line is a large Centri-Spray washer, followed in turn by an Apex air test unit, and final inspection.

This line is served by an Anchor Steel conveyor installation about 80 ft in length, consisting of five sections. Transfer of work is of inline type, travelling in the same direction as machine sequence. Floor type power-roll conveyor units are employed. The system also includes a roll-over blow-off station.

First operation, in the Cincinnati surface broaching machine, is the broaching of top and bottom surfaces, and both sides. All remaining operations then are completed in the three Greenlee transfer machines.

The first Greenlee machine includes 40 stations. Of these, 17 are working stations, two are turnover stations, one is a gaging station, one station handles blow-out and probing of 14 holes, the remaining stations being load and unload, and idle. The sequence of operations, in brief, is shown in Table I.

It will be obvious from the foregoing that most of the stations handle two heads at a time, while several stations take only one head at a time.

Next in line is a 27-station Greenlee transfer machine having

Perspective of Greenlee 31-station transfer machine on the cylinder head line. This unit performs operations on the top and contact faces. (Note: view taken on the erection floor before installation at GMC). This view emphasizes the arrangement of heads as well as the variety of angular heads required for this operation.

six working double stations, one single station, one blow-out and probe station with 16 spindles, two stations for rotating the work 90 deg. Heads come through in normal position with contact face down, continue in this manner up to station 21, the first rotating fixture. At station 22 and 23 the work is at 90 deg to the former aspect. At station 24 the work again is turned 90 deg.

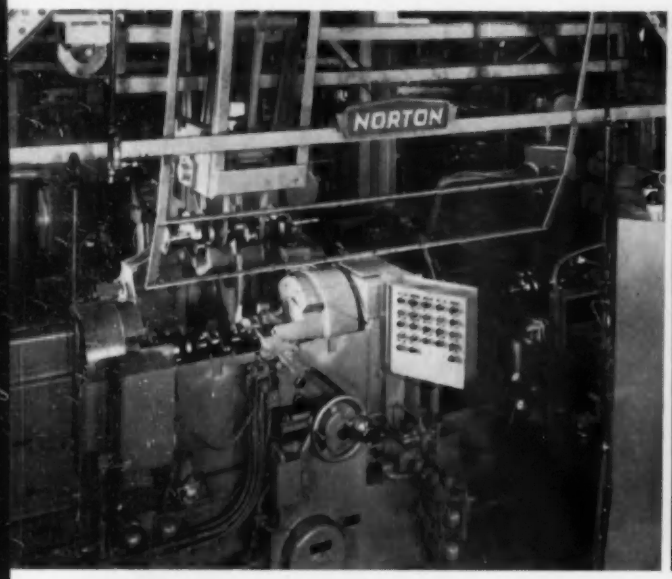
Operations in this machine are concerned primarily with drilling, reaming, tapping, end-milling and related operations. Active spindles include: one reaming; 34 drilling; 12 milling; 31 tapping; and five boring. As in the case of the first transfer machine, this one includes mostly angular heads.

We mentioned earlier that a single basic cylinder head is common to all engines. However, there is one variation, namely, that hardened valve seat inserts are required for the heavier duty V-6's and all V-12's. The third Greenlee, having just eight stations, handles the final finishing operations, including the finishing of valve throat and valve guide holes, finish-machining valve seats, and wet gun-boring valve guide holes. Due to the difference in valve seat diameter between the two types of heads, the heads are so spaced on the transfer conveyor that one type is finished at stations 3 and 4; the other at stations 6 and 7. This spacing is accomplished by loading two pieces at a time on the transfer conveyor.

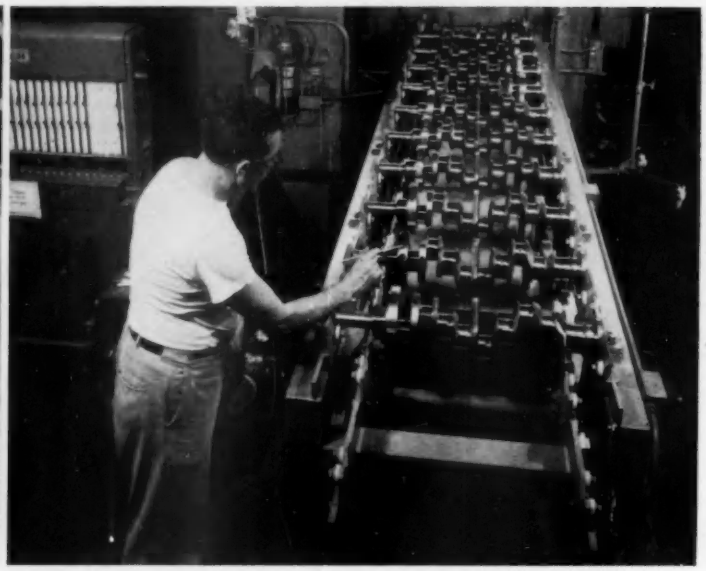
Following machining, there is a series of detail operations such as blow-off, Centri-Spray washing, air leak test, etc. Heads that pass preliminary inspection then are subjected to an air gaging machine where all holes are checked. It was shown earlier that the combustion chamber is completely machined in the first Greenlee unit. This is done not only to assure complete control of combustion chamber volume but to effect uniformity of volume among the chambers of a given cylinder head. At final inspection combustion cham-

SEQUENCE OF OPERATIONS ON GREENLEE MACHINE

Head	Station	Operation
LH Horiz	4	8 deep drills
	5	8 deep drills
RH Horiz	4	7 spindles – drill, chamfer, core drill
	5	4 spindles – ream, comb. ream & chamfer
6-deg Upper	9 & 10	6 spdl – comb. hollow-mill & face spring seats
6-deg Lower	9 & 10	6 spdl – rough-bore valve throats, rough-counterbore valve seat
14-deg Upper	12	6 spdl – drill pushrod holes 1/3-way
14-deg Lower	12	3 spdl – rough-mill combustion chamber
14-deg Upper	14	6 spdl – drill pushrod holes 2/3-way
	15	6 spdl – drill pushrod holes through
14-deg Lower	14	2 spdl – drill holes 1/3-way
	15	2 spdl – drill holes 2/3-way
LH horiz	19 & 20	14 spdl – drill
RH horiz	19 & 20	6 spdl – drill & counterbore spark plug holes
		Station 22 is the blow-off and probing of 14 tap holes
6-deg Upper	24	6 spdl – drill valve holes 1/3 through
	25	6 spdl – comb. spotface & chamfer OD valve holes
6-deg Lower	24 & 25	19 spdl – drilling
6-deg Upper	27 & 28	12 spdl – drill valve holes 2/3 and through
22-deg Upper	27	2 spdl – drill
LH horiz	30 & 31	28 spdl – spotface & countersink
6-deg Lower	30	6 stub spdl – comb. finish-bore & spotface valve guide
14-deg Upper	33	6 spdl – core drill pushrod holes through
6-deg Lower	33	3 spdl – finish-mill combustion chamber
18-deg Angular	35	6 spdl – semi-finish-ream valve holes



One of the seven units of the Norton unitized grinding machine for grinding V-6 crankshaft pins, one at a time. Overhead, in the center, may be seen the loading and unloading mechanism with one arm ready to load the part. At the extreme right is the transfer conveyor that links the seven machines in the line. The ground pin is gaged for size as it is returned to the conveyor.



Finished crankshafts on this conveyor line are checked for dimensional accuracy on the Sheffield Precisionaire gaging machine at the left.

ber volume is checked for a tolerance of plus or minus 1 cc.

It may be noted too that in the case of cylinder blocks and heads the castings are checked for Brinell hardness, hardness of the head being held between 187 and 229.

CRANKSHAFT MACHINING LINE

When it comes to crankshaft machining the procedure is a little more involved since GMC is currently using Armasteel cast shafts for some V-6 engines; forged shafts for all heavy duty V-6's. Moreover, since the crankshaft for V-12's is different in size, it is machined in a different department. In the case of the two V-6 shafts, the layout of equipment and flow of work is so arranged as to handle certain operations in the same machine, others in different machines. This will be explained more in detail below.

On the other hand, all equipment is arranged for flow of work in one direction in parallel lines about a central conveyor where cast and forged shafts require different machines. As shown in the illustrations, both crankshafts move along a central conveyor, feeding laterally to each machine by means of Wilson Automation on the side; feeding from the machine back to the main conveyor is by another Wilson link on the other side. Similarly, each of the machines is provided with automatic loading and unloading, thus making the entire sequence practically automatic in action.

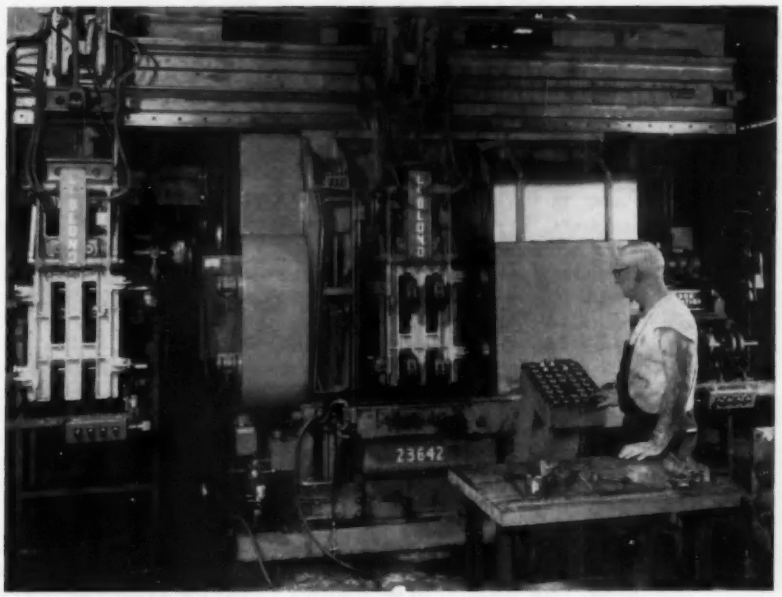
First operation, common to both shafts, is the milling of locating notches in a special Crankshaft Machine Co. unit. Main bearing line turning is handled in a group of Wickes center drive lathes, fitted with automatic loading and unloading. One group, equipped with carbide tools, takes cast shafts; a parallel group, equipped with h-s-s tools takes care of forged shafts.

In similar fashion LeBlond double-spindle lathes are set up for rough-cheeking all pin bearings at the initial stage; then another group for finish-cheeking. The LeBlond lathes on one side are equipped with carbide tools for cast cranks; those on the parallel line, for forged cranks, are equipped with h-s-s tools. LeBlonds are fitted with the familiar attachment for automatic loading and unloading.

Following roughing operations, both crankshafts converge for rough-grinding of the main bearing line in a battery of Landis multiple-wheel grinders. Then they enter Crankshaft Machine special duplex lathes for turning and chamfering all counterweight diameters, using carbide tooling. This is followed by spacing and forming of fillets on main bearings in another group of Crankshaft Machine lathes.

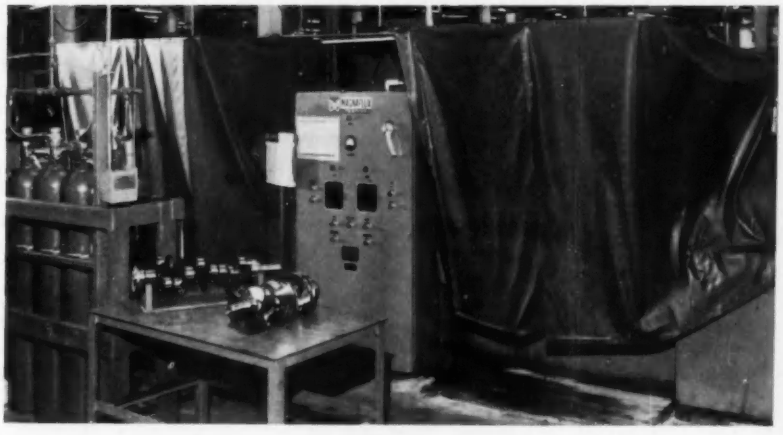
Next in line are the LeBlond lathes for finish-cheeking, followed by LeBlond double-spindle lathes for turning all crankpins. Turning operations handle both cast and forged shafts, and employ carbide tooling for the operation.

At this point both cast and forged cranks are going through the same equipment and enter a Leland-Gifford setup of six-spindle, three-position head deep hole drills for drilling all oil holes. From here the forged crankshafts are transported to the Tocco induction hardening machine for hardening all main and crankpin bearings. This is followed by a drawing operation



—RIGHT
One of the two-spindle LeBlond crankshaft lathes, this one being tooled for rough-checking and rough-turning all pin bearings. Note the massive LeBlond transfer mechanism for automatic loading and unloading of the machine. Shafts feed to the machine by Wilson Automation from one side; turned shafts are deposited on Wilson Automation on the other side for transport to the main feeder conveyor in the background.

—BELOW
Gisholt Dynetric balancing equipment in the crankshaft department. At the right is the balance drilling attachment.



—BOTTOM
Magnaflux Magnaglo inspection machine for the surface inspection of all crankshafts.

OPERATIONS ON CRANKSHAFT LINE

in an Industrial Metal furnace.

Returning to the machine line, the shafts proceed together for finish-grinding of the thrust main bearing, finish-grinding of remaining main bearings and oil seal diameter. Norton 10 x 36 angular wheel head grinders finish-grind two diameters on the stem end.

The next series of operations is the finish-grinding of all crankpin bearings, one at a time, in a unique Norton seven-station Unitized transfer machine. This is a development of the concept shown at the Machine Tool Show of 1955. It may be noted that only the first six units of the machine are required for the operation, the seventh unit being set-up for stand-by in the events of down-time on any one of the other machines in the line.

Noteworthy feature of the Norton equipment is that each unit is fitted with an automatic single-point diamond dresser for the face and radius of the wheel. GMC insists upon accurately-formed and well blended fillets. On the pins this is achieved by dressing the radius on the wheel after each pin is completed.

(*Turn to page* 63, *please*)

Comments by J. M. Bryant, chief engineer, Link-Belt Bearing Plant, Indianapolis, Indiana, and chairman of Sectional Committee B54, on the significance of the development of the new bearing code

1—The fact that the new American Standard, Bearing Code Identification, will be identical in all technical respects with the ISO Draft Recommendation 157, should prove a major spur to the export business of American bearing manufacturers. It means that all bearings similarly marked are interchangeable, regardless of the country or manufacturer. It should also be of great aid to American manufacturers who have already established plants within the spheres of the various trade groups in Europe, or those who are contemplating establishing plants in these areas. They will be able to manufacture a competitive product, which meets the specifications of the bearing industry of the respective countries.

2—Here, in the United States this new Bearing Code shows great promise of broad use. The reason for this is that during the past few years more and more consumers have been ordering bearing parts listing the AFBMA code numbers. The AFBMA code forms a substantial part of this new American standard. Stated briefly . . . it is the consumers who are forcing the manufacturers to go to the code, since it is they who derive the maximum benefit from its use. With the approval of B54.1, this trend should be even more marked during the next few years, until use of the bearing code has become an accepted fact for the entire bearing industry . . . manufacturer as well as consumer.

World Wide Advances Foreseen Through New Ball and Roller Bearing Code

SUBSTANTIAL cost reduction in the manufacturing and distribution processes and more direct control by the user over ball and roller bearing inventory have been made possible by the new American Standard Identification Code for Ball and Roller Bearings, B54.1-1960, just approved and published by the American Standards Association.

Great International Significance

According to J. M. Bryant, chairman of the Committee on Bearing Numbers of the Anti Friction Bearing Manufacturers Association, which sponsored the new standard, this code is also of great international significance since it has been used as the basis for an international standard being developed through the International Organization for Standardization (ISO). Mr. Bryant is the chief engineer of the bearing plant of the Link-Belt Company in Indianapolis, Indiana, and is also chairman of ASA sectional committee B54.

Draft ISO Recommendation 157, which was prepared by ISO Technical Committee 4, is now being voted on by all 44 member nations of ISO. If approved, the final document will be identical in all major technical respects with American Standard B54.1-1960.

Single Uniform System

Thus, a single, uniform international system for identifying ball and roller bearings will eventually be possible instead of the dozen or more different systems currently in use throughout the world.

Specifically, B54.1 distinguishes, as far as possible, each bearing on the basis of dimensional and functional interchangeability. It provides a universal language to facilitate communications between the user and the manufacturer. It is also meant to simplify the handling by the user's personnel of identical bearings made by different manufacturers whose various identification numbers may be difficult to interpret.

It is not intended that B54.1 give any intimation whatsoever of the availability of the different bearings. For such purposes the bearing manufacturers' catalogs must be used.

Adoption of B54.1-1960 represents the culmination of work begun in the early 1940's. At that time, the task of supplying this country's war machine accentuated the need for a uniform method to distinguish these products. Many times a bearing rushed to a distant location as an emergency replacement was actually in stock at the destination under a different number.

Code Published in 1950

In 1941, a committee of the Anti-Friction Manufacturers Association began work to develop a code that would end this costly practice. Portions of this code were completed by 1945. The entire code was first published for general distribution in 1950, as Section 5 of the AFBMA standards.

ASA Sectional Committee B54 was organized in 1946 under the sponsorship of AFBMA to study coordination of the AFBMA code with a code drawn up by the armed services during the war. The committee was authorized to handle all phases of developing a uniform identification code. The result is American Standard B54.1, representing nearly 20 years of con-

structive efforts by manufacturers, users, and armed services, for a code that would meet the needs of users in so far as standardized boundary dimension bearings are concerned.

An early draft of B54.1 was submitted to the International Organization for Standardization in 1952, as a working document for an international standard recommendation. After seven years of study and development, a final code was accepted by ISO Technical Committee 4, Ball and Roller Bearings. A total of 17 nations served as participating members of the committee. If it is accepted by the member nations of 150, the code will be promulgated as an ISO Recommendation. Acceptance and use of a recommendation by member nations and their industries, trades and professions is entirely voluntary.

According to John W. McNair, technical director of ASA, the benefits of a mutual effort, American and international, resulted in a materially improved American Standard, as committee B54 incorporated many suggestions from the international group into the final version of B54.1.

Interchangeability of Bearings

Since bearings of different makes are not standardized in detail of internal construction, a standardized number and identification system, such as this, must be applied with caution in order to avoid the use of identical numbers for bearings of a given size or type whose different internal design may affect functional interchangeability. There may also be installations where a bearing of one type, such as a cylindrical roller bearing, may be substituted for a bearing of a different types, such as a radial ball bearing. However, since specific code letters are used to designate different types of bearings, the user will not be able to ascertain from the standard alone whether the different types of bearings are interchangeable.

Bearing Parts Not Covered in Standards

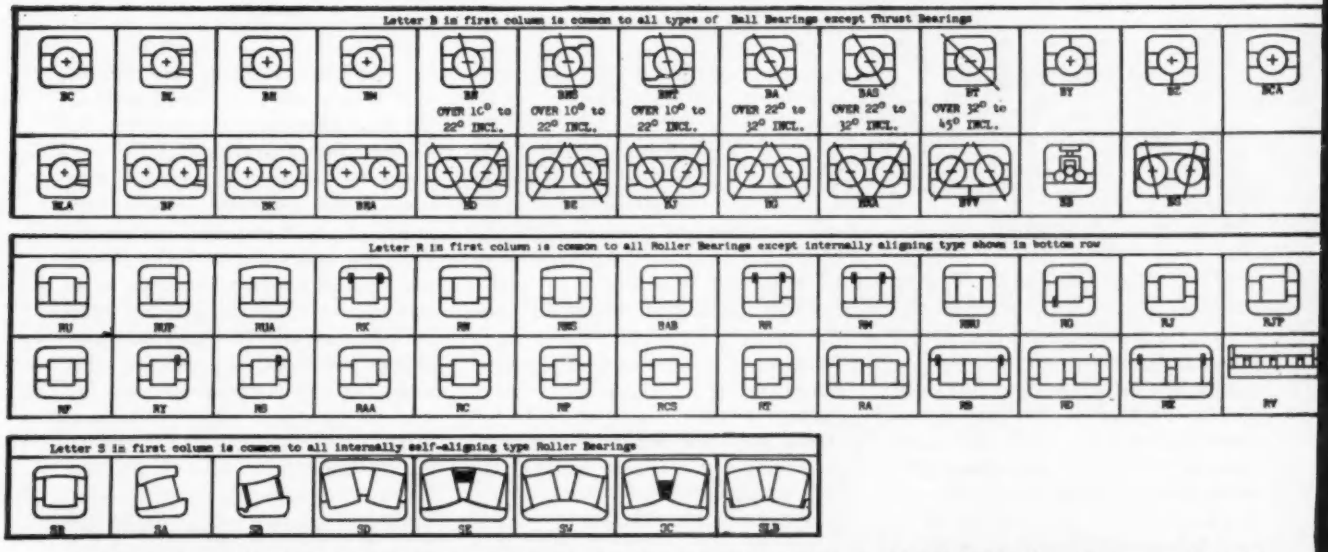
The system applies only under the specific conditions stated in the test of American Standard B54.1, and makes no provisions for the numbering or identification of component parts of separable-type bearings. The code has been developed to cover only those ball and roller bearings whose boundary dimensions and tolerances are in agreement with the American Standard B3 series on ball and roller bearings.

Ball and roller bearings are distinguished by means of types and principal dimensions: bore, outside diameter, and width. It also permits indexing of bearing characteristics conditioned by installation requirements.

The description applies only to those dimensions of bearings and bearing component parts that have been accepted as American Standard by ASA. The system can be expanded to cover other ball and roller bearings and component parts when such have been approved by the American Standards Association.

Developed under the sectional committee method of ASA procedures, the standard has been sponsored by the Anti-Friction Bearing Manufacturers Association. Seventeen manufacturer and user organizations from industry and government were represented on the B54 committee which drew up this standard. ■

LETTER IDENTIFICATION OF ANNULAR BALL AND ROLLER BEARINGS


Letter B in first column is common to all types of Ball Bearings except Thrust Bearings
OVER 10° to 22° INCL.
OVER 10° to 22° INCL.
OVER 10° to 22° INCL.
OVER 22° to 32° INCL.
OVER 22° to 32° INCL.
OVER 32° to 45° INCL.
Letter R in first column is common to all Roller Bearings except internally aligning type shown in bottom row
Letter S in first column is common to all internally self-aligning type Roller Bearings

The structure of the Code is a system of alternating groups of numerals and letters. The Code identifies the type and size of a ball or roller bearing by means of one group of numerals indicating the bearing bore diameter, followed by a group of letters indicating bearing basic type and one more group of numerals indicating outside diameter and width (or height) of the bearing. The code number thus obtained is called the Basic Number. Specific bearing characteristics conditioned by installation requirements may be identified by a supplementary number consisting of alternating groups of numerals and letters. Letter identification only is shown here.

In this view bodies have been painted and automatically sequenced into the various model ranges. They are now hoisted to the overhead conveyor for lowering to the ground floor where trim will be installed.

On the ground floor the painted body shells are upholstered and equipped on a series of parallel conveyors, each linked to the next by cross conveyors.

Ford's Modernization and Expansion in England

By J. Grindrod
Special European Correspondent
for AUTOMOTIVE INDUSTRIES

FORD MOTOR COMPANY'S modernization and expansion program in England, costing about $210 million, is claimed to be the most ambitious ever to be undertaken in the European motor industry.

One of the biggest features of Ford's facilities, the new body press shop, constructed and equipped at a cost of almost $17 million, ranks with the finest in the world.

It houses 12 lines of presses installed in six 80-ft bays and arranged in tandem to provide smooth flow production and to allow for the maximum use of automation. Each bay has its own service crane, two of which are of 50 tons capacity and four of 30 tons capacity. A seventh bay running at right angles to the other six is used for steel storage, blanking presses, square shears and roller levelling machines. This bay, also 80 ft wide, is serviced by two overhead electric cranes of 20 tons and 10 tons capacity respectively. The ground floor area of the seven bays totals 171,000 sq ft.

The presses are mounted on "birdcage" type steelwork over a 17 ft deep basement, having an area of 138,470 sq ft. This "birdcage" steelwork permits the relocation of presses to suit the demands of model changes without the necessity of excavating and constructing new individual pits and foundations. In addition, the presses can be partly maintained from basement level. The basement pit also alloys for the disposal of scrap from the presses.

Of the 49 presses installed, 18 are of the underdrive type. All are of American design and manufactured in Britain, 27 being Clearing presses made by Vickers Armstrong and 22 Danly presses made by Harland and Woolf. These machines are of the most modern type available and the underdrive types are all equipped with two speed, slow down clutches. This form of clutch permits a high operating speed with a slow draw speed combining increased output with improved quality in the product.

Ultimately the body press shop will consist of 76 presses, some of which will be transferred from the existing press shop. Moving these

presses will considerably improve working conditions and allow the relocation of equipment in a similar fashion to the new shop. Extensions to the existing shop have increased its floor area by 37,600 sq ft.

To match the productivity of the new press shop a highly efficient system for the disposal of scrap offcuts has been installed. Scrap is automatically cut to length in the dies and drops down specially constructed chutes into scrap bins below. When full, the bins are made up into trains and towed away to the bin tipper by an electrically propelled tractor. The scrap is tipped on to a steel conveyor and carried to a baling house outside the press shop and extending over the rail track at a height of 14 ft 6 in. A German Lindemann hydraulic press bales the scrap, produced at an average rate of 14 tons/hour and it is lowered directly into waiting railway cars by a semi-automatic electric magnet.

Movement of the wagons can be remotely controlled from the baler loading cabin and from this point the operator can couple, uncouple or shunt a train of cars.

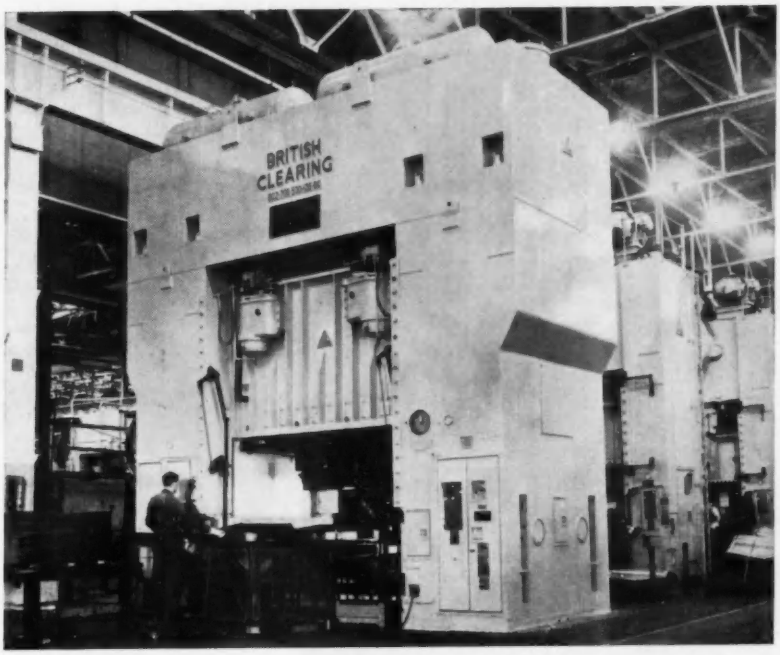
From the earliest days of production at Dagenham the bodies were painted and furnished at the Body Plant and then, for final assembly, conveyed by road to the main plant about 1½ miles away. It was an effective, if rather cumbersome, arrangement and in planning the site of the new Paint, Trim and Assembly Plant, the engineers bore in mind the desirability of having all the body processing and final assembly operations adjacent so that work could flow smoothly from one phase to the next.

It was finally decided that painting, trimming and assembly should be carried out in one two-story building 1215 ft by 630 ft which would be linked to the body making plant by a conveyor bridge. The top floor was to be for painting operations and the lower one for trim and final assembly. The site was the 48 acre Ford Sports Field, a new sports ground having since been laid out at Goodmayes, Essex.

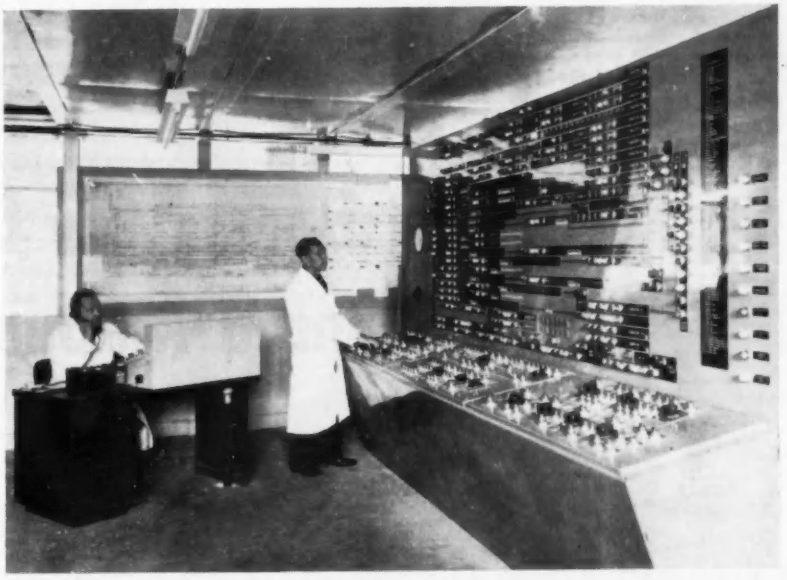
Some 725 ft long and built on reinforced concrete portals with a superstructure of steel lattice girders, the conveyor bridge between the two plants has been designed to maintain constant temperature and humidity to prevent oxidization on the bodies in their "white" state while in transit.

To provide for the unhampered handling and smooth flow of materials a system was devised by Geo. W. King, Limited, the sole contractors for the conveying arrangements, which would receive the unpainted body from the body group, take it across the connecting bridge and carry it overhead and at ground and raised levels to final assembly without manual handling at any point. The conveyor system used for the movement of bodies is entirely automatic, be-

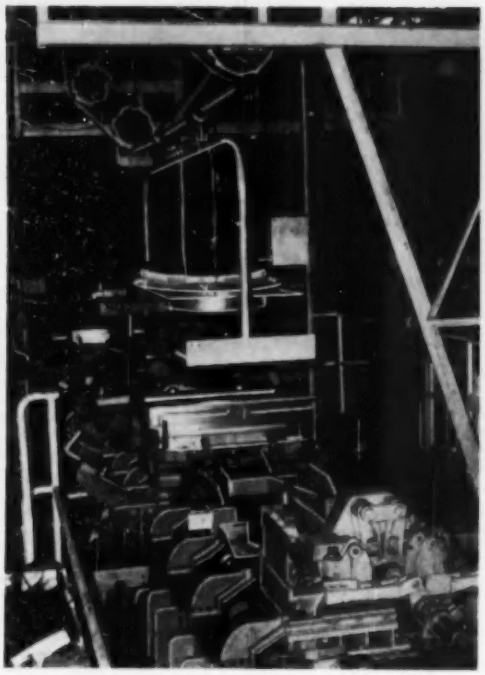
(*Turn to page* 80, *please*)



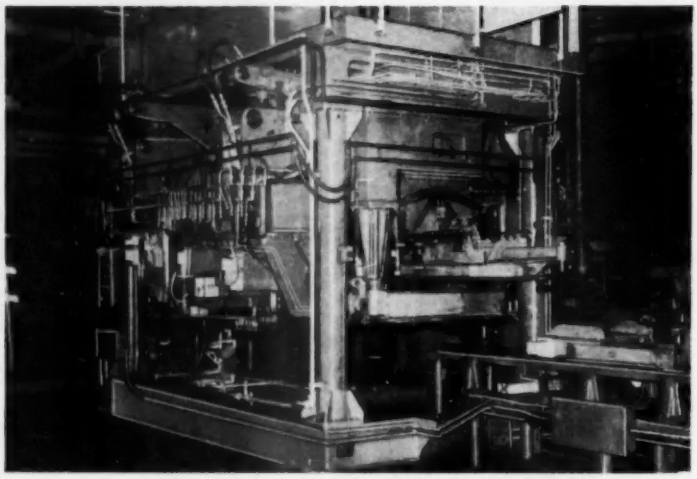
All of the 49 presses in the body press shop are British-made from American design.



One of the two main control rooms in the paint, trim, and assembly plant. Flow of bodies through the paint system is tracked and controlled from this room.



Start of the underbody welding circuit, where empty base fixtures on roller-mounted trolleys are loaded with longitudinal frame members and floor panels brought in on fitted carriers by an overhead conveyor. After clamping, the fixtures are transported crab-wise to the first work station at the head of the parallel length of track.



First Languepin welding press, where base fixtures entering the bridge-type unit are automatically uncoupled from fixtures on either side in the train before being elevated against the upper electrodes.

This is the second part of a two-part article. Part I appeared in the May 15 issue of AUTOMOTIVE INDUSTRIES

Simca Boosts Car Output with Advanced Machining Lines

PART II

By David Scott
Special European Correspondent
for AUTOMOTIVE INDUSTRIES

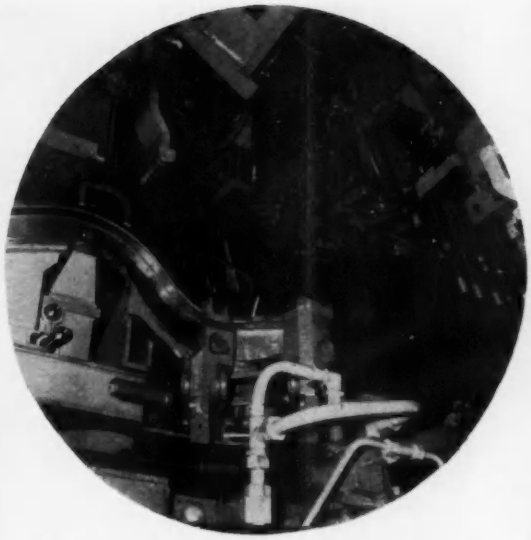
IN the welding shop at the Simca Poissy plant, which is located on the banks of the Seine 25 miles west of Paris, automation is widely applied in the assembly of unitized Aronde bodies. Floor sections are built up on a loop formed by two parallel lines joined by transverse chain conveyors at each end. There are 25 base fixtures on roller-mounted trolleys, interlocked by sliding couplings. Each train of 12 on the two tracks is indexed forward between operations by a short hydraulic transfer bar, while one trolley is always in transit across the ends of the lines.

The loading station is at one corner of the circuit, where an overhead conveyor brings in the two longitudinal tophat frame members, prefabricated front and rear floor panels, and several minor stampings on a fitted carrier. These are manually positioned and clamped in the fixture, while location dowels are pressed into front and rear suspension bushings by external hydraulic plungers.

The loaded fixture then advances to the end of the straight track where it is engaged by the transverse chain and moved crabwise as its coupling slides out of lock with the trolley behind. Reaching the start of the other track, the fixture locks onto the one ahead to be transferred forward with the automatic cycling.

This line is made up of five Languepin multi-point welding presses alternating with several handgun and idle stations. The presses do a total of 518 welds on the top and sides of the underbody, and have elevating tables that raise the fixture against the upper set of fixed electrodes. Before the trolleys are lifted their couplings are disengaged by a local sliding action of the female members,

Floor panels and frame members are joined on a bank of five Languepin welding presses with a total of 518 spots. After the fixture is elevated against the upper electrodes, hinged arrays of electrodes swing in from both sides.



Close-up of a section of the upper electrodes on one of the five Languepin presses, showing the frame member clamped in the base fixture.

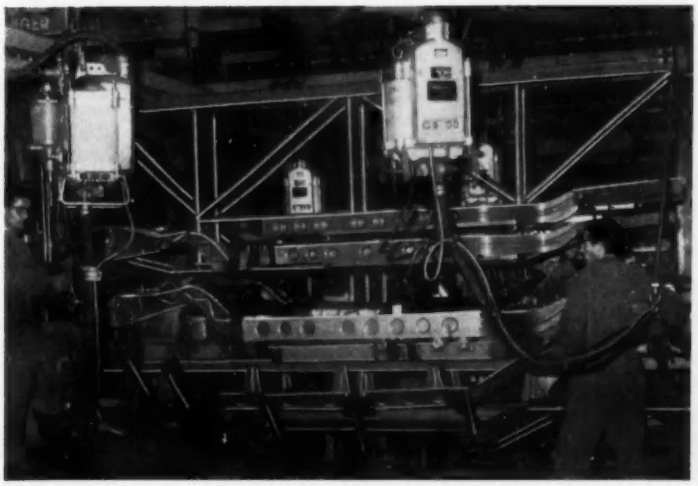
which are in the shape of an inverted U.

The Languepin at the first station welds 84 spots, those on the side frame members being done by banks of electrodes carried on hinged assemblies that swing inwards after the fixture is raised. This is followed by two handgun stations, and then the second press also does 84 welds.

Preformed strips enclosing the external open side of the frame members are added at the next position. Stocks of left- and right-hand stampings are kept on overhead rail-mounted carriers adjacent to both sides of this station. As a fixture arrives, strips are placed singly in the pair of simple hinged jigs which retain them by permanent magnets. The jig on each side is then swung up against the frame members and the stampings are tacked in place with hand guns.

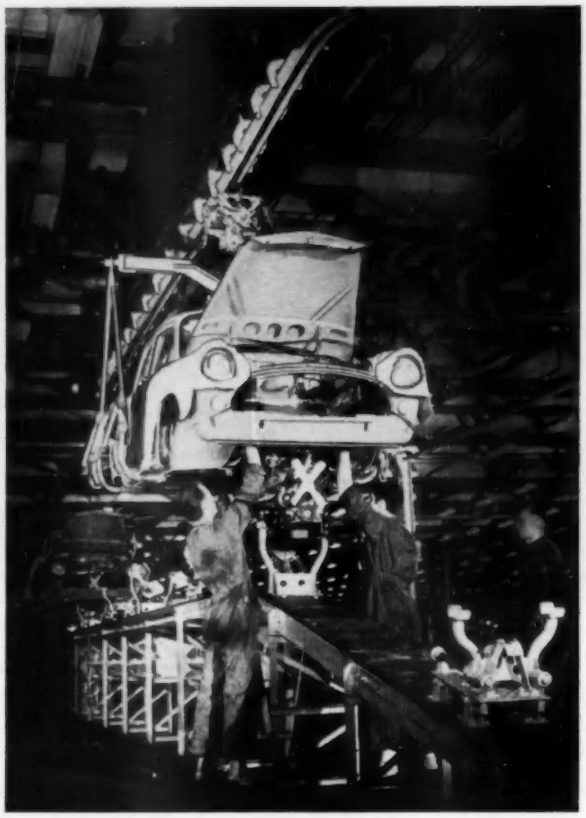
Floor and frame welding is completed at the subsequent three presses. Fixtures now enter a tunnel two stations long, bridged by a

Strips enclosing the longitudinal frame members are tacked on at this manual station, where the pressings are pre-loaded into the pivoting carriers on each side which are then swung inwards and locked against the base fixture.



Dropping track section at this station near the end of the underbody welding line simplifies adding the rear fender panels. Trolley couplings automatically disengage and the base fixture is lowered 18 inches, after which the two stampings, loaded in pivoting side-jigs, are positioned against the floor.

Split master jig on the upperbody welding circuit opens up to allow the loaded base fixture to pass between the two halves. It then closes in hydraulically to position the roof, door pillars and front cowl with toggle clamps prior to tacking with hand guns.



Body drop station on the Arcade final assembly line, where the conveyor rises to waist level. Engines and rear axles are carried on pedestals, and the power plant is bolted directly to mounting brackets on the frame members after the unitized body is lowered into place. Radiator and front suspension are added later.

platform for receiving and stocking pre-assembled rear sections and rear fender interior stampings which come in by monorail. These components are laid on the body floors as the fixtures emerge from the tunnel, and at the end of the track the trolleys are shuttled across to the start of the second section.

Here the fender interiors are first added, at a station where the length of track drops 18 in. to lower the fixture and underbody to within easy reach of the operators standing on a raised platform. Stampings are clamped in hinged jigs on either side, then swung inwards and locked to the fixture for tacking to the frame members adjacent to the wheel arches. These are welded in place at subsequent hand stations.

Trunk sections with external fender panels are added at the next station, where the fixture drops as before and side jigs are swung in to position the unit. Tacking and final welding follow.

At the unload station location dowels are withdrawn from the suspension bushings, and eight vertical pushers, built into the track at this point, raise the assembly evenly a few inches off the fixture to prevent distortion of the sheet metal. A carrier on an overhead monorail that descends at this station is clamped to the elevated floor section, and transports it along a separate manual line where some panel joints are gas welded and the jack sockets and other minor parts added.

Bodies are further assembled on an unusual rectangular line formed by a pair of identical L-shaped sections joined together by turntables at the four corners. Base fixtures circulate continuously around the track, although in fact it is two duplicated lines (to double output) having four stations on each side

(*Turn to page* 88, *please*)

Front suspension on its sub-frame, brought in by hooked carrier on an overhead monorail and hoist is positioned from beneath the body after the engine is in place.

Steel requirements for Mack's Allentown Division are discussed by "top team". (L to R: C. H. Trader, Asst. to Director of Purchases; H. A. Dickson, Factory Manager and C. A. Scharfenberg, Executive Engineer.)

"Team Concept" used at Mack Truck...*in buying* STEEL PRODUCTS

By Norman M. Lloyd
MARKETS EDITOR

MACK Trucks annually spends over $100 million for a variety of products, materials and services which are supplied by thousands of vendors located throughout the U. S. and Canada. Most of the major assemblies and parts for Mack vehicles are produced by the Allentown, Pennsylvania and Plainfield, New Jersey factories. These include engines, transmissions, axles, frames, drive shafts, cabs, fuel tanks, etc. The company's requirements for steel alone include several hundred items in mill shapes, bars, sheets, plates and tubing in approximately 38 different analyses and finishes.

A team of representatives from Purchasing, Engineering and Manufacturing acts as a collective clearing house for all material problems and purchases. The teamwork starts at the drawing board and continues through the examination of an operating vehicle. The efficiency of the system has proved itself by reducing costs, improving product quality and encouraging vendors to supply better materials.

A group interview with C. A. Scharfenberg, Executive Engineer, H. A.

Factory Manager Dickson discusses face milling operation on large steel casting. Intimate knowledge of manufacturing techniques is a must for Mack executives.

Dickson, Factory Manager, and C. H. Trader, Assistant to the Director of Purchases, reveals some significant facts concerning the buying practices for steel.

Q: What coordination of effort exists between major departments in reaching a purchasing decision for steel?

A: Responsibility for the purchase of such basic materials as steel is shared by Purchasing, Engineering and Operations (Manufacturing). Very briefly, Engineering specifies the material to be used, Manufacturing determines the economics of production, and Purchasing selects the supplier.

Although the coordination that exists is mostly informal, the Standards Committee, which is composed of quality control specialists from both Engineering and Manufacturing, meet regularly to set material standards. When specified materials would have to be purchased in mill quantities and the requirement doesn't justify buying it, they will request a material substitution.

Q: Can you be more specific with reference to Engineering's buying influence?

A: In addition to setting material specifications, they evaluate, on a cost basis, every material deviation and/or new part before it is released for production.

A constant effort is made to use standard steels. Where these will not suffice, our Research Department creates special formulas to satisfy product requirements.

Q: Does Engineering specify the source or the supplier?

A: No, this is the responsibility of our Purchasing Department. The steels specified are usually available from a number of sources. For new developments, however, Engineering will sometimes specify by brand name if it is the only material acceptable to us at the time.

Q: How does Manufacturing influence the purchase decision?

A: Manufacturing determines material costs on the basis of tooling, fabrication and raw stock prior to releasing the material for production. When production problems can be traced to the material in use, they will ask for a review. In some instances, they will recommend a more suitable material based on past experience or suggest a drawing change and continue production with the same material. The Manufacturing Department normally reviews selected materials on major program revisions, but no approval is required for routine changes. They also directly influence the quantity of the purchase. In studying the economic production of quantities, they will often request inventory stock to save set-up time and thereby reduce costs.

TEAM CONCEPT IMPORTANT

"The team concept of purchasing basic materials is vitally important in producing a quality product at reasonable cost that can be delivered to the customer on schedule. Our capability of continuing operations during any lengthy interruption, for example, demonstrates the importance of this buying concept."

JOHN M. STEFFEE
Director of Purchases
MACK TRUCKS, INC.

Q: In considering Purchasing's role, what factors are considered when making a choice of suppliers for steel, for example?

A: A vendor company must rate favorably on the following points: engineering, competitive price and terms, geographic location, available production capacity, financial responsibility, willingness to supply, adequate and proper equipment, administrative staff and ability. A complete survey of the bidder's facilities and capabilities is made by Purchasing, Engineering and Manufacturing. The results of this study provide both quality and source control and will often justify the selection of someone who is not low bidder.

These points are not necessarily given in their proper order, as some assume a position of greater importance according to the type of material or product to be purchased.

Q: How would you advise a company to seek consideration as a supplier?

A: Products should be advertised and specifications and quality made known to us. They should also follow up with direct solicitation by salesmen.

Q: Normally, how many suppliers do you seek for a basic material such as steel?

A: Usually two or three.

Q: After a purchase has been made, is reordering an automatic process or are other sources still sought?

A: The vendor who has once established himself as a source and continues to meet all requirements gets first call. Steel prices are not too great a factor because practically all mills adjust their freight allowances to remain competitive. Geographic location is more important.

Q: Other than Purchasing's primary responsibility to determine the source and order the material, what factors would influence the purchase decision?

A: Purchasing has the job of maintaining a proper working in-

(*Turn to page* 89, *please*)

MACK TRUCKS, INC.

LOCATION ALLENTOWN, PA.

GENERAL ENGINEERING SPECIFICATION 814GS 19980

SUBJECT

1.0 MATERIAL SPECIFICATION - STEEL, BAR

2.0 SCOPE - Pin, Front Axle Steering King SHEET 1 OF 1

3.0 APPLICATION - Trucks, Buses, Fire Apparatus

4.0 REQUIREMENTS

4.1 CHEMICAL COMPOSITION - AISI - C1141 (Modified)

C. - .42-.51
S. - .10-.15

4.2 HEAT TREATMENT (Reference)
Induction Harden
Core - Cold Finished Bar-190 min.
Surface - R.C. 60-65
Case Depth - .046 min.

4.3 MECHANICAL PROPERTIES - Core Ave.

TENSILE STRENGTH (PSI)	112,000
YIELD STRENGTH (PSI)	95,000
HARDNESS (BRINELL)	190 min.
REDUCTION IN AREA (%)	40.0%
ELONGATION IN 2" (%)	14.0%

4.4 QUALITY - Fine Grain - 5-8
Cold Drawn Bar conforming with ASTM-A108

4.5 IDENTIFICATION - Bar ends paint gray with black stripe

4.6 TOLERANCES - All conforming with ASTM-A29

4.7 FINISH - Bar-Comm. Cold Drawn surface

5.0 GENERAL INFORMATION - Must be free from injurious defects as per ASTM-A29

NO. 814 GS 19980

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REV.	ISSUED ITEM	DATE	NO.	BY	REMARKS	ENG'G. APPR.	MAT.	QUALITY	DESIGN
B									
A	11-3-58	60093R00							WRM
								PROJECT F.A.P.	DRFTG. S.A.C.

FORM NO. SS 1977

Material spec sheet calls out requirements for front axle king pin. Details sharpen quality and reduce rejections.

R. E. Warmkessel, Drafting Supervisor, and Scharfenberg hold down material costs by double checking all drawings before release.

METALS

Rate of Orders for Steel Has Been Barely 50 Per Cent of Ingot Capacity. No Chance at Present for Steel Price Rise.

by William F. Boericke

Steel Operating Rate Declines

Steel operations declined further in May and it is expected they may drop further through the balance of the second and most of the third quarter. Some steel executives now fear the operating rate could slip to the low 70's before turning up in the fourth quarter. According to *Iron Age* the rate of incoming business does not justify any optimism as the overall rate of incoming new business is well below current shipments. Obviously this means that sooner or later production will have to be curtailed to gear with new orders. At present the rate of incoming orders has been barely 50 per cent of ingot capacity. Partial explanation for the decline comes from need to work off inventories of foreign steel that had been bought during the strike and which could not be cancelled when it ended.

Price Rise Doubted

Because of the fierce competition for business any idea of a price increase for basic steel has gone aglimmering. Consumption normally drops off in the hot summer months and with ample steel available a price rise seems just wishful thinking. There's a chance for an upturn when steel for the 1961 automobile models is required. These trial runs will probably be placed with the mills in July for August delivery but the initial tonnages will not be large.

Steel users are demanding and getting speedy delivery for their orders although it means that lead time is held to a minimum. About the only product that can be classed as being in a sellers market is structurals.

Inventory Adjustment Appears Completed

Some major mills have noticed a steadier rate for incoming orders although this occurs at a low level. But it could indicate that inventory adjustments among their customers may have been completed. Metal users have probably been cutting up steel in their manufacturing operations fast enough to support the present operating rate at the mills and perhaps to exceed it. As long as end use consumption of steel stays up inventories cannot be cut much further. But opinions differ in the trade. The mills are no longer getting the big advance order bookings they were used to last winter and forecasts must be made on day-to day orders for immediate shipment.

The majority opinion is that output will drop only slightly before leveling off for the second quarter. It may drop again during the July vacation period and then turn up seasonally in the third quarter. But it's still guesswork.

Stainless steel orders are at a low ebb. On the West Coast Japanese stainless has been offered about 15 per cent under domestic prices. In several areas prices are weak and warehouses have done some cutting.

Scrap Market Depressed

The market for steel scrap remains dull and listless with no confidence in a turn for the better in the near future. With the steel operating rate still declining no improvement in demand for scrap is expected before fall. Prices continue under pressure and are now at the lowest level since the spring of 1959. Number 1 heavy melting scrap is down $7 to $9 a ton at various centers and in mid-May was quoted about $34 a ton at Pittsburgh down from $46 six months ago. The price might not hold even at this level if it were not for substantial export business with Japanese and European steel mills heavy buyers.

Stainless steel scrap prices are more or less nominal. Consumers could probably buy small tonnages below quoted prices. However the quantity available appears limited. Ferro chrome exothermic alloys have been cut about 10 per cent as a competitive step.

Aluminum Business Off in First Quarter

Producers of primary aluminum admit that business in the first quarter of this year was not up to expectations and in consequence completion of some of the new facilities that were scheduled to come on stream at an early date may be held up. In commenting on the drop in sales and profits for his company in the first quarter, a Reynolds official declared that unfavorable comparisons with 1959 resulted from the end of put sales to the Government stockpile, less demand from home builders and the automotive industry, and more especially because heavy purchases were made in the last quarter of 1959 by consumers anxious to get under the wire before the ensuing price rise. In effect a good deal of the fourth quarter business was borrowed from the first quarter. In consequence, Reynolds was operating at about 80 per cent of capacity. Nevertheless, it was expected that sales would be up 10 per cent in 1960 over 1959.

Much the same was said by an Alcoa official, that business has fallen short of boom expectation because of an indefinable uncertainty in the minds of consumers, but when this uncertainty has ended a substantial upturn in the use of aluminum will take place.

(*Turn to page 76, please*)

Torrington Needle Bearings are available for shafts up to 7¼" in diameter. Full complement of rollers provides highest radial capacity for a given cross section. They offer low unit cost, compactness and light weight and long service life. They take a press fit in a simple straight-bore housing, run directly on hardened shafts, permitting use of larger and stiffer shafts.

Why not put a Torrington Needle Bearing on that large shaft?

You have everything to gain by applying a large diameter Torrington Needle Bearing in your heavy duty applications.

There's the unusual economy in price and installation cost over other anti-friction bearings of comparable size. Simplicity of design of related components saves even more. Unequaled capacity for a given cross section, good lubrication and efficient anti-friction operation mean long service life.

These advantages have been proved in performance in tractor bolsters, transmissions and final drives. In haybaler crank shafts. In power shovels. In heavy duty hydraulic pumps and starting motors. In road wheel arms on tanks. Why not talk over *your* application with your Torrington representative?

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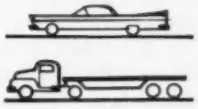
THE TORRINGTON COMPANY Torrington, Conn. • South Bend 21, Indiana

Circle 122 on Inquiry Card for more data

25
00L
CAPACITY
48 SCHOOL CHILDREN
NO STANDEES

Budd wheels deliver... everything



In every part of the country, every corner of the world . . . Budd-made wheels are used for the transportation of all kinds of cargo . . . from school children to ballistic missiles. More than 60 million wheels for trucks, trailers, buses and off-the-highway vehicles have rolled from Budd plants. And many of them are still rolling after more than 5 million miles.

A recent Budd development has now produced wheels that are 10% stronger . . . with no addition in weight, no increase in cost. Such developments are typical of the foresight with which Budd facilities are being applied to serve the automotive industry. The Budd Company, Detroit 15.

AUTOMOTIVE Budd DIVISION

Since 1916 — serving the automotive industry with research, design, engineering and specialized production facilities.

News of the MACHINERY INDUSTRIES

By Charles A. Weinert

Proposed Standardization of General-Purpose Machine Tools, and the Significance of the Exposition in Meeting Foreign Competition, are Major Topics at NMTBA Meeting

Builders at 58th Spring Meeting of NMTBA Discuss Exposition and Standardization

The Machine Tool Exposition-1960 and proposed standardization of general-purpose machine tools were top billings at the 58th Spring Meeting of the National Machine Tool Builders' Association.

Held last month in New York City, the meeting had an attendance of about 375 machine tool executives and guests.

Alan C. Mattison, president of NMTBA, talked about foreign competition in pointing out the significance of the Exposition. He said the only ways for American metalworking manufacturers to meet foreign competition is to stabilize costs and transform technology into lower prices—"in short, again become competitive." Modernization of plant and equipment, in his opinion, is the primary answer—since there are no immediate prospects for higher tariffs, lower taxes, lower wages, or lower material costs.

Mr. Mattison declared, "If we can stabilize wages, I think we can regain our competitive position for the reason that technology on behalf of increased productivity is now moving ahead in this country at a rate such as we have never seen before. It is not too late. It isn't necessary for American metalworking manufacturers to accept foreign competition as an unbeatable proposition.

"When metalworking executives see the possibilities of the machines that will be exhibited in Chicago (Sept. 6-16), they will realize that with those machines, plus anti-inflation management policies, they can regain control over costs, they can reduce costs, they can once again be able to offer better things to more people at lower prices."

The most "dramatic" development at the meeting was the formal presentation to Association members of proposed areas of standardization and nomenclature for general-purpose machine tools.

The presentation was made by members of the Coordinating Committee, Users General Purpose Machine Tool Standardization Group, headed by R. L. Witsche of International Harvester Co. This committee is principally composed of representatives from automotive companies, including Ford, General Motors, Chrysler, John Deere, Mack, and IHC. In addition, Colonel Wiley represented the Department of Defense in endorsing the project.

The presentation was substantially a repetition of that given in Detroit recently (see AI for April 15, page 65)—plus recommendations to Association members in the way of setting up committees for getting the program into operation.

Basically, the users, group requested the support and cooperation of the machine tool builders in establishing standards. Mr. Witsche, chairman, suggested the formation of standards committees made up of representatives from industry, the machine tool builders, and the Department of Defense. Under such an organizational plan there would be four working committees — for drilling, grinding, milling, and turning machines — operating under a coordinating committee and a planning committee.

As the first step, Mr. Witsche asked that the Association select one man to sit down with representatives of industry and DOD, and mutually formulate overall plans and policies. Following this meeting, he asked that representatives be selected for each of the standards committees—and said he would like this to be done and work begin by June 1. Then he hoped that by the first of the year the standards for at least one size of machine tool in each category would be established.

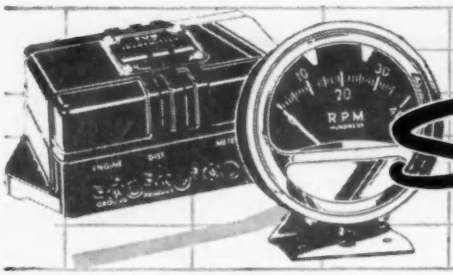
Mr. Witsche further mentioned that the intention of the users is to urge working area and mounting standards on *all types* of machine tools. That the initial effort on drilling, grinding, milling, and turning machines has been limited to specific types only to avoid undue complication at this stage. Mr. Witsche indicated the plan is a long-range one by saying it would probably take five years to complete. ■

Norton Has Anniversary; Opens New Wheel Plant

Last month the Norton Co., in celebrating the 75th Anniversary of its founding, programmed a series of open-house days over a period of two weeks at Worcester, Mass.

One of the major events was the unveiling of a brand new $6.5 million, 225,000-sq-ft plant for the manufacture of organic-bonded grinding wheels. At the same time, a number of product developments

(*Turn to page 62, please*)



Sun TACH-O-GRAM

One in a series of technical discussions on Tachometers.

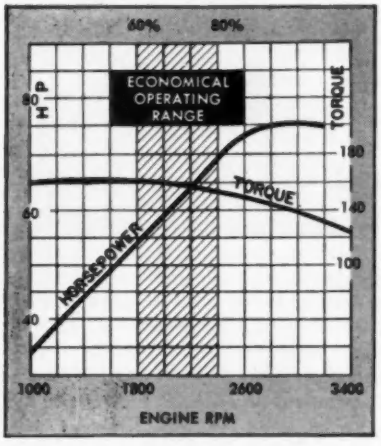
Vehicle Operators Agree Sun Electric Tachometers Help Reduce Engine Wear

Fleet owners, through the use of carefully kept comparison records, have proved that Sun Electric Tachometers make a big difference in reducing engine wear . . . and even gas and oil bills.

These records show that Sun Tachometer equipped vehicles actually had longer engine life, along with a pronounced reduction in overall maintenance costs. Here's why.

Economy Operating Range

Every engine has an economic operating range—60% to 80% of the speed at which it delivers its rated horsepower. Frequent engine operation above or below the economical operating range results in high fuel consumption, excessive strain, and premature wear on vital engine parts.



A Sun Electric Tachometer helps prevent this. It tells the driver when to shift gears to stay in the economy range. All he need do is keep the Tachometer Indicating Hand between the two white arrows. These arrows which are pre-set to mark the high and low points of the proper RPM range.

Critical RPM Zone Kept in View

Because this range is always in view, drivers avoid such hazards as "lugging" and "overspeeding." They're able to get maximum fuel miles per gallon. And on fleet maintenance record sheets, this care shows up as maximum trouble-free engine performance — reduced engine wear — lower service costs.

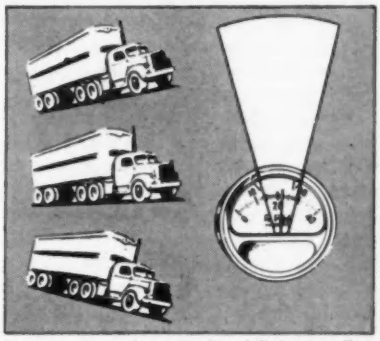


Diagram shows how on "up hill long pulls," "level cruising," or "down grade driving," Sun Tachometers show driver when to shift to keep engine in correct RPM range.

Electric Type Preferred

Based on field test reports, operators have found that the Sun Electric Tachometer gives smoother, steadier, more accurate readings—and is less subject to pointer waver. The electric type is not affected as much by bumps, holes or washboard roads.

Bump Proof Because of "Ruggedized Accuracy"

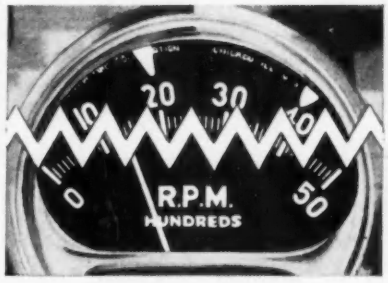
This preferred "Bump Proof" feature of Sun Electric Tachometers, is made possible through the use of a rugged D'Arsonval Movement, with Jewels mounted in silicone rubber.

This greatly reduces shock or vibrations, and is not found on any other type or make Tachometer.

This is a Sun manufacturing exclusive, and is called "Ruggedized Accuracy."

It affords longer Tachometer life and greater accuracy. Beryllium hair-springs minimize spring fatigue.

Adding to this tough, "Ruggedized" feature, is the use of Alnico magnets, for permanent strength — and double bridge construction.



Wide Applications

These features add up to proven big benefits for fleet operators—and also are the reasons why Sun Tachometers are in demand for Automotive, Marine and Stationary engines; both Gasoline and Diesel types.

Samples Available

Why not look deeper into the "inside story" of Sun Electric Tachometers. By doing so you may find that for your application the electric Sun Tach is the best answer.

Samples are available immediately for engineering tests, along with reference catalog bulletins and print specifications. Just fill in the coupon below for immediate action. Thank you.

AVAILABLE FOR ORIGINAL EQUIPMENT OR REPLACEMENT

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Makers of Electric Tachometers for Automotive, Marine and Stationary Engines; both Gasoline and Diesel.

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I'm interested in the Sun Electric Tachometer story!

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Title.....

Firm.....

City.....Zone.....State.....

875

Circle 124 on Inquiry Card for more data

NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

By C. J. Kelly
ASSISTANT EDITOR

Diamond Grit

DESIGNATED "Selected Natural Diamond," a highly improved diamond grit differs significantly in particle shape from conventional grit and is reported to increase grinding efficiency of resinoid wheels in certain applications. It consists of a preponderance of needle-shaped and plate-shaped particles, a difference that can be easily seen under microscopic comparison. *The Industrial Diamond Div., Englehard Hanovia, Inc.*

Circle 35 on postcard for more data

Sheet Metal Handling

VACUUM lifting pads are offered in a wide range of lift power. According to the manufacturer the pads are rated safe from 25 to 4,000 lbs. These pads can be utilized in many different production operations. *Airlock Mfg. Co.*

Circle 36 on postcard for more data

Production Storage

COLLAPSIBLE wire mesh boxes have been designed for use in shipping and storage operations, and for the production line. The wire boxes, which fold to pallet height for easy storage, are available with capacities of either 2000 or 4000 lbs.

Termed "Loadtainers" by the company, the boxes are fabricated from 2-gage, 70,000 psi minimum tensile strength wire welded into 2 by 2 in. spacing. The sides are helixed to the ends at opposite corners for easy folding, and also to the deck section for extra strength. The deck uses ⅞ by 1½ in. hot rolled steel for the end channels and ¼ by 1½ in. bar stock spaced across the bottom for additional support.

Offered in either the Atlas or Titan series, all boxes have a basic capacity of 2,000 lbs. This may be increased to 4,000 lbs. without adding to the size by welding two vertical reinforcing wires to each corner, and two horizontal wires to each end and side. On both Atlas and Titan Loadtainers, heavy-duty, non-slip locks are provided so that sides cannot accidentally open.

The Atlas Loadtainer has structural corners that resist shock, and the steel legs, welded to each corner of the base frame, are said to be practically indestructible. *The Republic Steel Corp.*

Circle 38 on postcard for more data

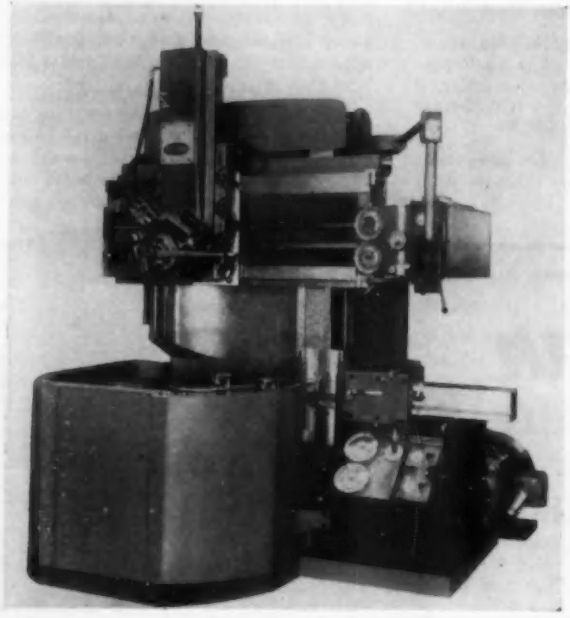
Superfinisher

A new superfinisher has been developed with highest flexibility as the main design feature. Mounted on the bed are the headstock and tail stock

and a vertical platen. To this basic machine can be added a second vertical platen to permit superfinishing as many as four different areas simultaneously. *The Gisholt Machine Co.*

Circle 39 on postcard for more data

New Feature On All Bullard Vertical Turret Lathes



A completely new concept in machine tool control has been named "Size-Au-Trol." Functioning like a silent sentinel, it brings the cutting heads automatically to a stop when they reach pre-set positions during each successive stage of the machining operation. This new machine feature can be applied to internal boring, as well as external turning and facing. This device is especially advantageous for blind hole boring. Electro-mechanical devices provide a positive linkage between the control system and the rapid traverse. The Bullard Co.

Circle 37 on postcard for more data

Developer Units

TWO new developer units have been designed for use with the Copyflex model 42 exposure unit. They can be used to make ready-to-use diazo prints on the spot. The motor driven unit takes sheets up to 42 in. wide by any length, and develops at a speed of six linear fpm. The unit is only four in. high, and operates from 115 V, single face, alternating current. *Charles Brunning Co., Inc.*

Circle 40 on postcard for more data

New Bearing Test

A NEW type of permanently lubricated rubber bearing for automobile suspensions is evaluated by recording performance under road conditions and comparing it against that of standard bushings.

Comparative evaluation is conducted by mounting the right front suspension control arms of an automobile on the new type bearing and the left control arms on standard Silentbloc bushings. Vibrations of the control arms are picked up by four Brush Instruments Type 1 Metrisite linear motion transducers. The base of each transducer is mounted on the frame of the automobile. The sensing arm rests against a plate attached to the control arm of the automobile. Two of the transducers sense vibrations of the upper control arms and the remaining two sense action of the lower control arms.

Output of the Metrisites is fed to a Brush Instruments 5612 carrier amplifier and then to a Brush RD 2321 00 two channel direct writing recorder.

The Metrisite sensing arms are carefully mounted and the sensitivity of the amplifier set such that a plus or minus 0.100 in. movement will produce full-scale deflection in the recorder. Since the transducer output is relatively high the amplifier must be set to its lowest sensitivity to prevent the recorder pen from being driven off scale. *Clevite Harris Products.*

Circle 41 on postcard for more data

Jig-Locking Device

TURNING of a control automatically adjust the holding pressures from 1 to 1500 lb on a new jig-locking device. This unit has been developed in two models, one has base dimensions of 4 by 4 in., the other is 5 by 5 in. *L-W Chuck Co.*

Circle 42 on postcard for more data

Precision Grinder

MICRO inch finish at production speeds is a feature of the fully hydraulic, No. 206, feed surface grinder.

Built around a solid one-piece column and base, it assures permanent alignment between vertical head ways and cross travel ways. The amount of cross feed is controlled from a panel on saddle front and the cross feed itself is variable up to ¼ in. per table reversal.

This new machine is equipped with a Vickers vane type pump and a Gallmeyer & Livingston-designed control valve—giving an infinite number of longitudinal table speeds up to 110 fpm. Also provided is a variable speed continuous cross feed for dressing or quick positioning. Saddle may be automatically reversed at any predetermined point by adjustable dogs mounted on side of base.

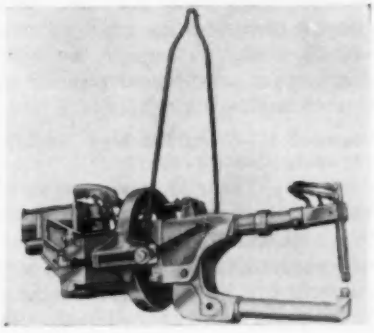
The vertical movement of wheel head is made by a large (outer) hand wheel and/or small (inner) one, conveniently located on the head of the grinder. The large hand wheel, used for coarse vertical adjustment and graduated in widely spaced thousandths, moves 0.060 in. with one turn. While the small hand wheel, providing a fine vertical adjustment and graduated in tenths of thousandths, moves .012 in. with a turn. *Gallmeyer and Livingston Co.*

Circle 43 on postcard for more data

AUTOMOTIVE INDUSTRIES KEEPS YOU INFORMED

New Welding Gun

A PORTABLE spot welding gun has been developed to operate in the 18,000 amp, 1350 lb pressure range. It is an air operated, fully automatic, water cooled unit and will handle material from the lightest gauge to 2 by 3/16 in. It is equipped with a gyroscopic suspension system for easy rotation. *Aro Spot Welders, a Div. of the Guthry Machine Tool Corp.*

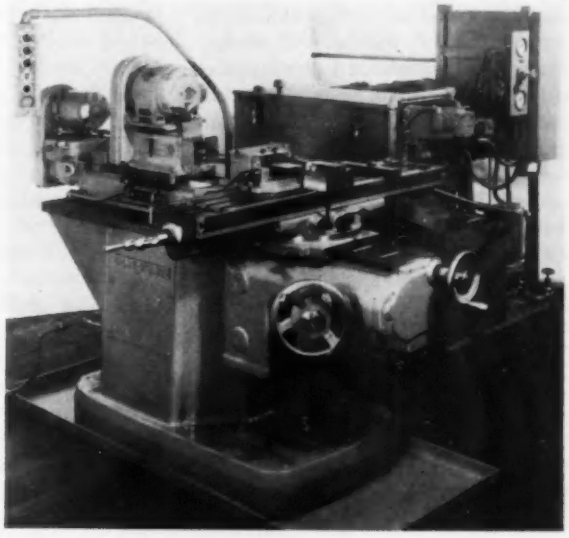


Circle 44 on postcard for more data

Drilling Machine Eliminates Expensive Tooling

A NEW deep hole drilling machine, of the revolving drill type, has been developed to provide flexibility of set up and economical production of accurately drilled parts. Utilizing the built-in advantages of rapid work positioning and simplified tooling possible with knee-type construction, this unit does not require the fixtures normally used for accurate hole location.

This line provides capacities from ⅛ to 1 in. with a 12 to 24 in. feed stroke; spindle speeds and feed rates suitable for a wide range of work; rapid advance and return; positioning to 0.001 in.; 28 in. longitudinal, 12 in. traverse and vertical travel; and other features. *Brown and Sharpe Mfg. Co.*



This new deep hole drilling machine is available with many optional features that can be applied to meet a specific production operation. Primarily designed to handle a large variety of work, it is best utilized in precision machining applications. The unit was developed at the Machine Tool Div. of the Brown and Sharpe Mfg. Co.

Circle 45 on postcard for more data

Vehicle Design Developments by Army-Industry Teams

(*Continued from page* 35)

quired by the fuel cell. The electric drive required by such a power source would be much less of a problem than these first two problems. The direct current motor has long propelled street-cars rapidly and efficiently. Of course, we would look for lighter, smaller and waterproof electric motors for application to military vehicles.

Question 11—What has been developed on transistorized engine ignition circuitry?

Answer:—Transistors are being employed in the development of medium and heavy voltage regulators. The regulators have no moving parts and are capable of regulating generator or alternator voltage and current within very close limits and are responsive to voltage change of .1 volt. These units are no larger than present types. They offer longer life and a very minimum of maintenance is needed.

One company is developing under an Army contract a low tension creepage gap ignition system. The power supply component of this system incorporates a transistor as a switching device to eliminate high current breaking problems in the primary circuit contracts. The circuit is designed so that the breaker points are interrupted by the transistor base current for the switching cycle and as a result only a fractional current is interrupted compared to conventional systems.

The use of transistors in the distributor to supplant the contact points is under investigation for automotive ignition systems. ■

NEWS OF THE MACHINERY INDUSTRIES

(*Continued from page* 58)

were discussed.

The new facility, known as Plant 8, provides Norton with about 50 per cent added production capacity on resinoid, rubber, and shellac-bonded grinding wheels. Designed to give both increased productivity and improved product quality (balance, uniformity, and duplication), the plant is modern in all respects and contains the latest in mechanized equipment.

Recent product developments mentioned by Norton Co. officials include wheels of 75 Alundum, a new harder abrasive of aluminum oxide designed for the grinding of stainless steel billets and slabs. These wheels are said to be capable of removing twice as much metal per wheel as the best wheels previously used. Norton has also successfully synthesized abrasive-quality diamonds—although commercial production is not contemplated for the present.

An inkling of what Norton's Machine Tool Div. may display at The Machine Tool Exposition-1960 was disclosed during the sessions. The exhibit will consist of a total of 19 machines—15 grinding and lapping types, and four gear-making machines. It was stated that 14 were completely new designs.

Pratt & Whitney Co., Inc. Marks 100th Anniversary

On the occasion of its 100th Anniversary, Pratt & Whitney Co., Inc., marked the big event at West Hartford, Conn., with an elaborate program starting on May 7 and continuing through the remainder of last month.

Many of the affairs were for local people, but May 12 was allocated to a press reception and, from May 19 on, to visits from manufacturing-industry guests.

At the press reception, the major feature was the official dedication of Pratt & Whitney's Centennial Hall. It is a new permanent exhibition hall established by P&W to house and demonstrate the company's latest machine tools, gages, and cutting tools. Typical of the newest machines and equipment on display were the following:

The Numeric-Keller, a tape-controlled version of the Keller tracer-controlled millers. It is a three-dimensional milling machine, equipped with Bendix tape control system. Horizontal and traverse motions of the table; and vertical motions of the cutter spindle and feed rates are controlled by punched paper tape. Table travel is 36 in. longitudinally and 12 in. transversely, while vertical slide travel is 22 in. The table working surface measures 48 by 30 in.

The new P&W Numerical-Head Jig Borer, also equipped with tape control. In addition to automatic positioning of the table, this machine has fully-automatic selection of spindle speeds and feeds, automatic rapid-traverse positioning of the spindle and quill above the work, and automatic control of boring depth and cycle.

Around the Industry

Motch & Merryweather Machinery Co.—Alvin J. Jones has been elected vice-president and will manage the Machine Tool Manufacturing Div. at the Euclid, O., plant. D. M. Hallier also has been elected vice-president, and will head the Cutting Tool Manufacturing and Allied Products divisions.

National Automatic Tool Co.—Eugene Makie, formerly with Utica Div. of Curtiss-Wright Corp. and Dearborn Engine Plant of Ford Motor Co., has joined Natco as vice-president in charge of manufacturing. Mr. Makie replaces A. B. McCrea, who has been appointed vice-president in charge of finance.

Gisholt Machine Co.—Harvey A. Waddell has been elected vice-president, and Robert H. Bruce appointed vice-president in charge of sales. ■

New Continental Multifuel Diesel Engine

(*Continued from page* 37)

heads. Replaceable cast iron liners of dry type are fitted in all cylinders. The crankshaft is a one-piece forging of seven-bearing design with Tocco-hardened journals.

Pistons are aluminum alloy, permanent mold castings, cam-ground and tapered. The spherical combustion chamber is cast in place, then later machined overall. Four piston rings are used, the bottom one being an oil control ring.

The coolant system is of balanced manifold type incorporating an aluminum water header manifold. Its function is to maintain an equal distribution of coolant around each cylinder head, thereby eliminating hot spots or unequal thermal stresses.

In addition to the water header manifold, the engine employs aluminum in other parts such as the timing gear cover, oilpan, and smaller details.

Although the testing of the LDS-427 engine has been going on for a considerable length of time, publication of the results was withheld until sufficient field experience was accumulated under a variety of climatic conditions. As of March 1, 1960, a number of vehicles were tested by the Army for a total of 199,500 miles of which 49,328 were run on gasoline, 53,690 on JP-4, and 96,482 on Diesel fuels.

It may be noted that Ordnance used two types of vehicles: one with standard transmission; the other with an Allison automatic transmission. Testing was conducted under a variety of conditions both as to climate and terrain. Climatic conditions included arctic in Alaska and Canada; temperate at Fort Knox; and desert at Yuma. In each instance, they used the three principal types of fuels at various times in the same engine.

Under arctic conditions successful starts were made to minus 40F and other cold starts were made with exceptionally good results. At Aberdeen one of the engines completed approximately 24,000 endurance miles in addition to dynamometer operation, for a total of some 900 hours. Recently, the same engine successfully climbed a 60 per cent slope four consecutive times. This test was conducted on Ordnance gasoline, 83/91 octane with a vehicle payload of 2½ tons.

Finally, it may be noted that, although these engines are manufactured under license, they represent unique features that have been developed by Continental. The question naturally arises whether this type of engine is suitable or desirable for commercial applications. Certainly commercial haulers do not face the problem of logistics that is the common lot of military operations. Nevertheless, there must be specialized applications where a multifuel engine could be most useful. For one thing, proximity to a refinery would make it possible to use any fuels that are off standard specifications, or vehicles operating in remote areas could use any kind of fuel available enroute, switching to any fuel available at the scene of operations.

According to Continental, the multifuel engine could be modified for commercial use at cost comparable with a Diesel engine. That should provide a clue as to possible usage commercially. ■

V-6 and V-12 Engine Production

(*Continued from page* 43)

Automaticity is obtained by a special loading mechanism, employing two arms—one for lifting a crankshaft from the conveyor and loading into the machine; the other for unloading from the machine and returning the part to the conveyor. There is another automatic feature well worth noting. As the unloading arm deposits the ground shaft on the conveyor, the pin is automatically gaged and the indication posted on the air gage where it can be seen by the operator. The same procedure takes place at each of the six grinding stations.

Crankshafts now move on the conveyor to a 25-station Ex-Cell-O transfer machine where the following operations are performed: semi-finish and finish-face flange; semi-finish and finish-turn flywheel pilot diameter; drill, ream, tap, and spotface holes in the flange; and mill keyways.

Work now goes to two new Gisholt No. 2U Dynetric Balancing machines, served by a Leland-Gifford balance-drill unit at the side. Bob weight eliminators are employed in the machine. Balance is held to a total tolerance of ½-oz in.

Microfinishing of the shaft is done in an Impco four-station machine. It knurls the oil seal diameter, polishes all main and crankpin bearings, polishes side walls of the thrust main bearing. Surface finish is specified at 10-microinches (RMS). Incidentally, the diameter of pins and journals is held to 0.001 in. total tolerance.

Now that all major operations have been completed, the shafts go through an Impco 10-station brush and flushing machine — brushing and flushing all oil holes. This is followed by thorough washing in a Centri-Spray machine.

Final operation is a complete inspection in a special Sheffield air gaging machine, followed by surface inspection in a Magnaflux Magnaglo machine. The latter operation assures freedom from fractures and surface imperfections, thus assuring freedom from fatigue failure in service.

Finally it may be noted that all V-6 crankshafts are processed without recourse to straightening at any stage. ■

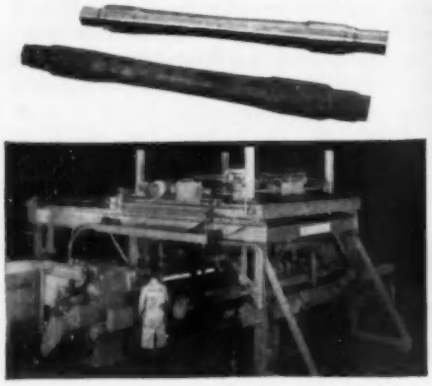
Better Transit Urged

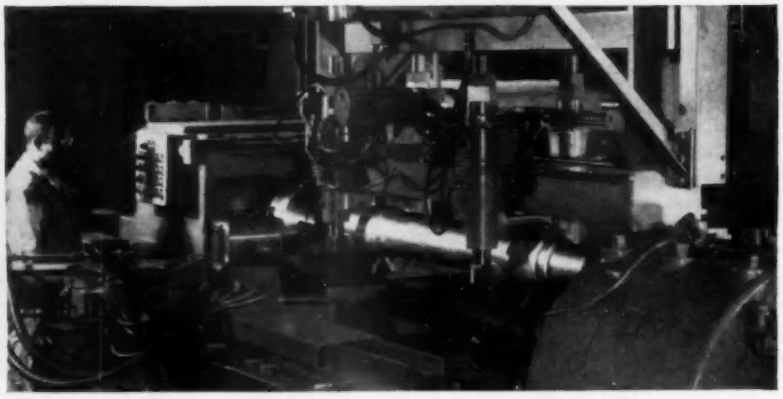
More effort should be expended to improve mobility of people, Lloyd F. Howard, General Electric Co. transportation expert, told a retail clinic sponsored by the National Retail Merchants Association in Houston, Tex. Mr. Howard called for sound planning which would effect a balance between private and public transit facilities.

SUNDSTRAND "Engineered Production" METHODS

...practical ideas for men who are responsible for manufacturing quality, quantity, and profit

TRACER TURNING *300-hp tracer lathe automatically loads, turns, and unloads 1800 lb. locomotive axle forgings*





Over 400 lb. of stock is removed from 1800 lb. locomotive axle forgings in an 11 minute cycle on this 300 hp Sundstrand tracer lathe. Parts are loaded, tracer turned and unloaded in a completely automatic cycle. Forgings range from 4 to 12 inches in diameter and 6 to 9 feet in length.

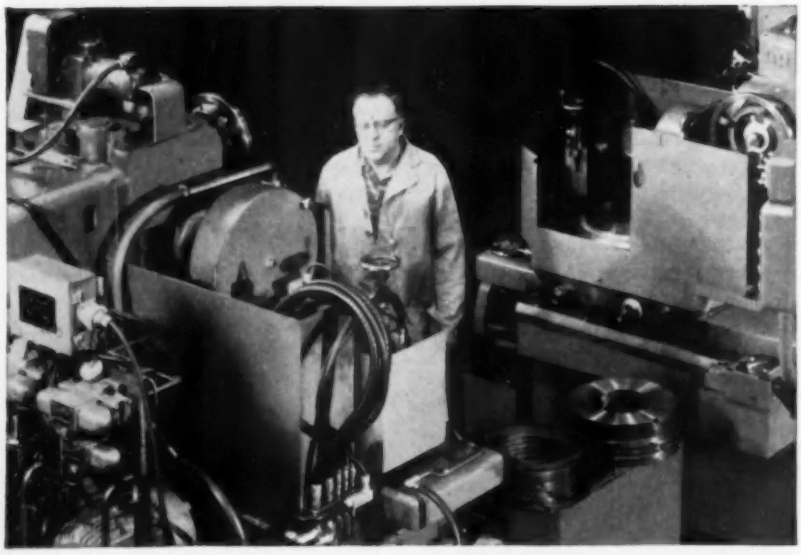
Ends are milled to length and centered prior to turning. With this new Sundstrand Lathe, production increase averages 4 to 5 times over previous method of turning these shafts.

The machine has one front and one rear tracer slide, each controlled from templates which are easily changed for varying sizes of workpieces.

A similar Sundstrand lathe is used for finish turning the axles.

For details on Sundstrand tracer lathes, ask for Bulletin T-615.

ROTARY SURFACE GRINDING *Operator runs two machines to ruff and finish grind 14" clutch plates at 45 per hour.*

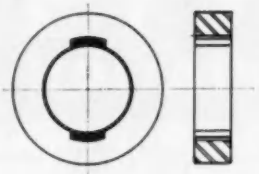


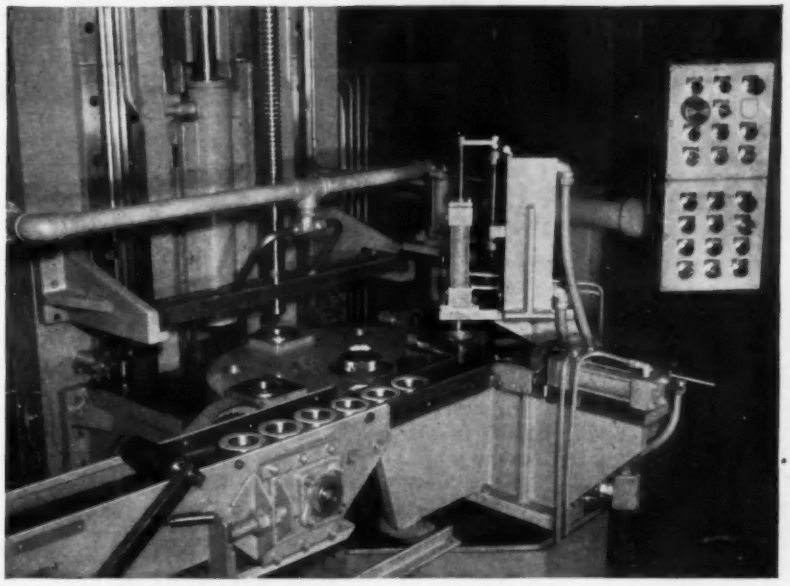
These two 20 hp Sundstrand-Arter grinders have the rigidity and power necessary for heavy cuts and fast stock removal. They ruff and finish grind clutch plates to an over-all flatness of .001", total indicator reading — repeatability within ± .0005". Required finish of 30 to 40 microinches is easily held; but finer finish is obtainable with these machines. Stock removal is from .009" to .012" per side.

The entire cycle is automatic except for load and unload, including fast feed for heavy stock removal with automatic change to slow speed for fine finish. When one side is finished on the first machine, the operator simply turns it over and positions it on the magnetic chuck of the second machine. Production is 45 pieces per hour per side per machine at 85% efficiency. *Ask for Bulletin G-615.*

INTERNAL BROACHING

Fully automatic cycle loads, broaches, and unloads gear blanks three at a time





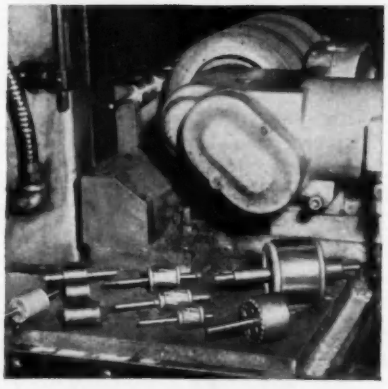
The ID and two splines are automatically broached at a rate of 350 per hour (at 100% efficiency) by this Sundstrand-American machine.

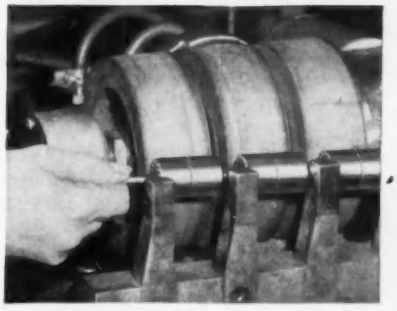
Parts are fed into a fixture by belt conveyor, stacked three high, indexed, machined, and ejected onto the outgoing conveyor. The entire cycle is fully automatic. While parts are being loaded at one station, other parts are being broached. The machine also is equipped with automatic chip conveyor.

Bulletin No. B-615 describes Sundstrand-American vertical and horizontal broaching machines.

CYLINDRICAL BELT GRINDING

Production increased 500%; equipment cost cut 60%; floor space reduced 50%





Use of a special cylindrical grinding fixture mounted on the automatic in-feed table of this Sundstrand-Engelberg belt grinder provides grinding of electric motor rotors to a tolerance of .0002 to .0004″. Diameters are accurate to ±.0005″. Rotors without shaft are mounted on an arbor, as shown at right. Rotors with shafts, at left, are held on their own shafts. A production cycle takes as little as 12 seconds.

The savings listed above are not uncommon wherever Sundstrand-Engelberg precision abrasive belt grinders can be employed to replace other classes of equipment. Literature available upon request.

THE CASE STUDIES LISTED HERE ARE TYPICAL OF THE RESULTS ACHIEVED THROUGH SUNDSTRAND'S "ENGINEERED PRODUCTION" SERVICE WHICH ANALYZES YOUR MACHINING REQUIREMENTS AND ESTABLISHES THE METHODS AND EQUIPMENT WHICH WILL GIVE YOU THE GREATEST OVER-ALL PRODUCTION ECONOMIES.

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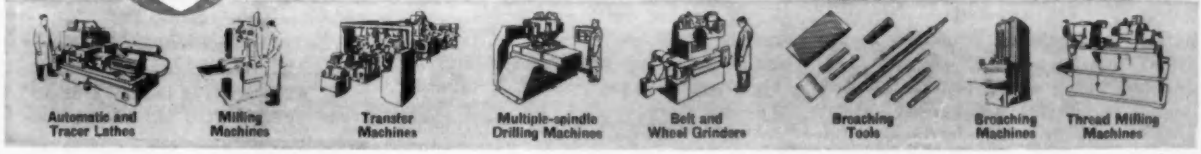
SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION



Circle 125 on Inquiry Card for more data

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

By C. J. Kelly
ASSISTANT EDITOR

New Brake Lining

A new brake lining has been developed for longer wear and greater safety. The manufacturer reports this development has a fade point 500 deg higher than the next best lining on the market. Because of this high fade point there is no standard bonding agent that can be used to adhere this lining to the shoe. Consequently, any shoe used must be the rivet type. Another advantage reported was that water had no effect on the stopping ability or operation of this lining. *Nagel Engineering.*

Circle 60 on postcard for more data

Brake System Components

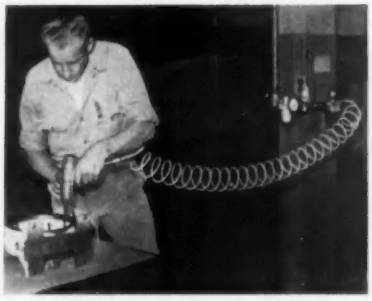
Gladhands are quick-disconnect couplings used on the air-brake systems of truck-trailer equipment. Since safe operation of the truck trailer depends upon them, they must be rugged, durable, and dependable. Manufactured from "Delrin" acetal resin they offer the following advantages: A single-position, ramp-type lock which eliminates the troublesome ball jamming and spring breakage sometimes experienced with metal constructions, lighter weight (50 pct lighter than aluminum; 75 pct lighter

than iron), corrosion resistance, nonsparking characteristic (greater safety in hauling flammable materials), color coding if desired (red for emergency and green for service lines), and a new break-away safety feature utilizing the resilience and stiffness of acetal resin, which allows the couplings to separate under a gradually applied load before the air hoses break. *United Plastics.*

Circle 61 on postcard for more data

Self-Storing Air Hose

Specifically designed for applications where air hose coiling on the floor is a problem, a new self-storing industrial air hose is now available. This new development can be applied to numerous hand tools that require air for activation. It is manufactured from a special flexible polyamide formulation, and has a quality of inherent imperviousness to oils. This hose is also supplied with a



spring guard to prevent crimping. The pressure range goes to 200 psi. Maximum working length is 20 ft, while when coiled it is under 1 ft. *Sinflex Products Div., Samuel Moore and Co.*

Circle 62 on postcard for more data

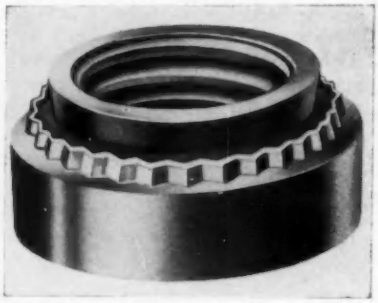
New Spray Application

A new system for the spray application of decorative vinyl finishes to a wide range of industrial products has been developed. With this system the application of vinyl dispersion coating can be applied to aluminum or steel and plain or textured metals. Vinyl coating features excellent corrosion resistance, toughness, resiliency, unlimited color range, and a high resistance to abrasion. *Metal and Thermit Corp.*

Circle 63 on postcard for more data

Midget Fastener

Tiny fasteners have been designed to provide load bearing threads in



sheet metal of thicknesses down to 0.032 in., and of Rockwell hardness of B-70 or less. They can be installed by any pneumatic or oil-hydraulic squeezer, into previously punched or drilled holes. Another feature reported is self-clinching, which positively locks them into sheet metal with a high push-out and torque resistance. Also they do not project on the reverse side of the sheet.

They are made in carbon steel with various rust resistant finishes and in type 303 stainless steel with thread sizes from 0 to 3. *Penn Engineering and Mfg. Corp.*

Circle 64 on postcard for more data

New Alloy Steel

Designers in the automotive, industrial and military equipment fields are expected to show a keen interest in a new alloy steel that has been developed for applications where lightweight and outstanding strength are important factors in design planning. This new steel has been designated "T-1," and when heat treated to a yield strength of 100,000 psi, it is reported to have three times the strength of structural carbon steel, of the same thickness. *United States Steel Corp.*

Circle 65 on postcard for more data

AUTOMOTIVE INDUSTRIES KEEPS YOU INFORMED

Rotary Switch

The development of a new rotary circuit selector, or stepping switch, powered by the new Size 5 Digimotor has been announced.

The Digimotor drive is a reliable, long-life power unit, available in unidirectional or bi-directional models. It is permanently lubricated, jamproof, and operates at a "whisper" noise level. The drive has a magnetic anti-overcoast, and all parts are enclosed in a protective housing.

Self-stepping is provided by a new transistorized pulser incorporated into the switch package. With no mechanical parts to wear out, unaffected by dust, humidity, fungus or variations in altitude, the pulser meets all environmental requirements of MIL-E-5272. Standard stepping rate is 6 to 8 pulses per second, but faster stepping can be provided.

The free turning shaft allows manual setting of the switch to any position, clockwise or counterclockwise, and shaft extensions allow mounting of supplementary loads and position indicator.

The new switch can be ordered with one through ten switch decks, and in 8, 10, 12, 18, 20 and 24 positions. Applications include stepping, counting, programming and sequencing. *Ledex Inc.*

Circle 65 on postcard for more data

New Insert Valve

New cartridge type insert valves have been designed to go inside the hydraulic device that they control. They are installed by slipping them into machined cavities, inside a cylinder, manifold or control handle. Some of the advantages claimed for this product are weight saving and reduced component cost. *Humphrey Products Div., General Gas Light Co.*

Circle 66 on postcard for more data

Smog Control Device

SMOG-FORMING poisonous gases are recirculated through the engine to be burned off before they enter the atmosphere, by a new device that has been developed by a team of Oklahoma engineers.

Originally developed to improve engine efficiency and cut maintenance cost, the unit will remove poisonous and noxious gases from the crankcase, and return them to the engine to be burned off. *Oildex Corp.*

Circle 67 on postcard for more data

Hardness Measuring

Called the model 1500, a gauge has been developed for measuring the hardness of materials such as plastic and rubber.

This gauge indicates hardness in Durometer units that comply with ASTM specifications for rubber hardness. The vernier reads directly to 5 points which permits interpolation to about 2 points with average vision. Runner is pushed down for new readings in a manner similar to a tire gauge.

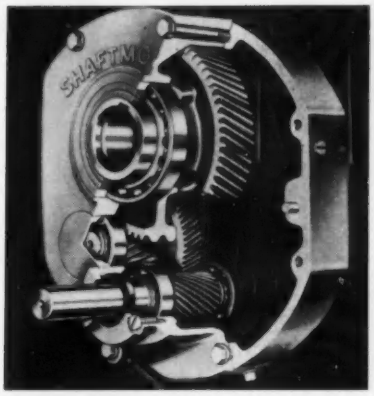
This gauge has a hardened steel indentor, made to close tolerances, which comes in contact with the material being tested. This indentor pushes up the runner of the vernier by direct contact. The runner is then held by friction so that the instrument can be removed and read elsewhere. *Rex Gauge Co.*

Circle 68 on postcard for more data

Direct Mounting Reducer

A speed reducer for direct mounting on the driven shaft offers a choice of two ratios—15 to 1 or 24 to 1. Designated type GC, this unit is offered in a range of sizes covering ¼ to 40 hp, and speeds from 125 to 5 rpm.

The gear teeth employed in this reducer are hardened to 45/50 Rockwell C. *U. S. Electrical Motors Inc.*



Circle 69 on postcard for more data

New Spring Wire

A new precipitation-hardening austenitic alloy, known as NS-A286, has been introduced for spring wire for 600 to 1000 deg. F service. Costing about one-tenth as much as other more highly alloyed exotic materials, NS-A286 is finding initial application in jet engines and gas turbines.

NS-A286 experiences as little as half the percent-relaxation loss at 1000 F as comparable alloys at 850 F (0.080-in. samples subjected to 40,000 psi stress for 10 days).

NS-A286 is made of nickel (24 to 27 pct), chromium (13.5 to 16 pct), titanium (1.75 to 2.25 pct), manganese (1 to 2 pct), molybdenum (1 to 1.5 pct), silicon (0.4 to 1 pct), aluminum (0.35 pct, max.), vanadium (0.1 to 0.5 pct), carbon (0.08 pct, max.), phosphorous (0.04 pct, max.), sulfur (0.03 pct, max.), boron 0.001 to 0.01 pct), and iron (balance).

Sixteen hours at 1350 F precipitation-hardening is recommended for springs after they are coiled to increase the physical properties and to improve stability at 600 to 1000 F. Typical tensile properties for annealed 0.080 in. NS-A286 are 103,500-psi as drawn and 176,000 psi after 16 hours at 1350 F; for 15 pct reduction are 122,500 psi as drawn and 190,000-psi after 16 hours at 1350 F. Tensile properties for 30 pct reduction are 150,000 psi as drawn and 198,000 psi after 16 hours at 1350 F. *National Standard Co.*

Circle 70 on postcard for more data

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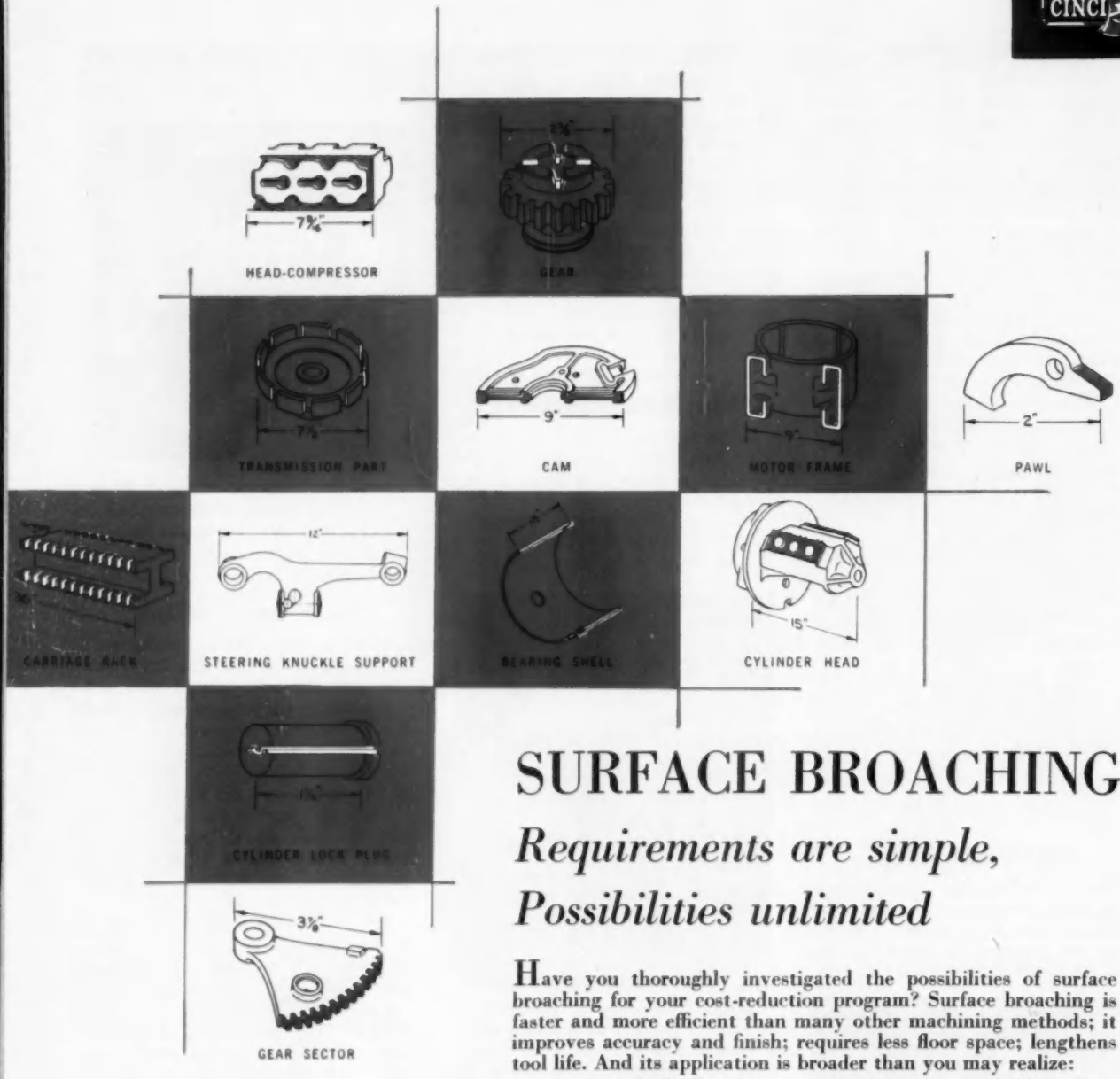
CINCINNATI



SURFACE BROACHING . . .

Requirements are simple, Possibilities unlimited

Have you thoroughly investigated the possibilities of surface broaching for your cost-reduction program? Surface broaching is faster and more efficient than many other machining methods; it improves accuracy and finish; requires less floor space; lengthens tool life. And its application is broader than you may realize:

- any part which allows cutter teeth to pass across the face of the machined surface, without interference from work or fixture, is logical for surface broaching
- any part produced on a continuous basis, or nearly so, justifies initial tooling costs
- or, on a job lot production basis, families of parts can be broached profitably with interchangeable tooling
- several surfaces can be broached simultaneously, or in one or more settings of the workpiece
- even fragile or light parts can be tooled up to withstand the broaching thrust
- parts which cannot be tooled for broaching often can be redesigned to take advantage of surface broaching's economies

Illustrations above indicate the variety of parts being broached at the lowest possible cost on Cincinnati equipment. Our Surface Broaching Specialists will be glad to discuss applications in *your* shop. Literature on request. Write SPECIAL MACHINE DIVISION, THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO.

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SPECIAL MACHINE DIVISION

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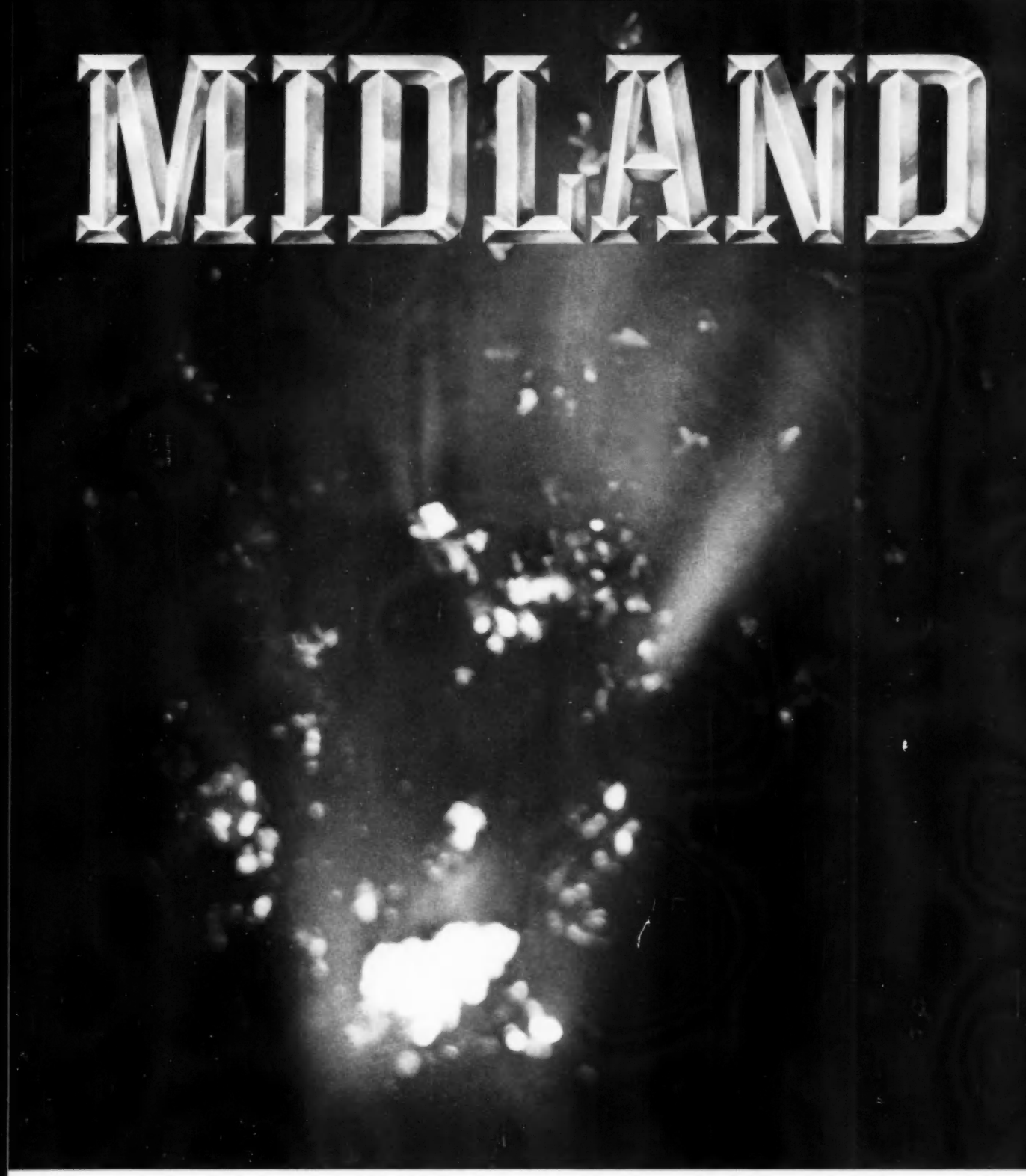
MIDLAND



Research and Development at Work

Heat—the greatest enemy of the brake system—is being brought under control by advanced approaches to safety in Midland-Ross laboratories. Here research and development is forging a new safety link to protect automotive America.

AIR MIDLAND BRAKES

MIDLAND-ROSS CORPORATION

POWER MIDLAND BRAKES

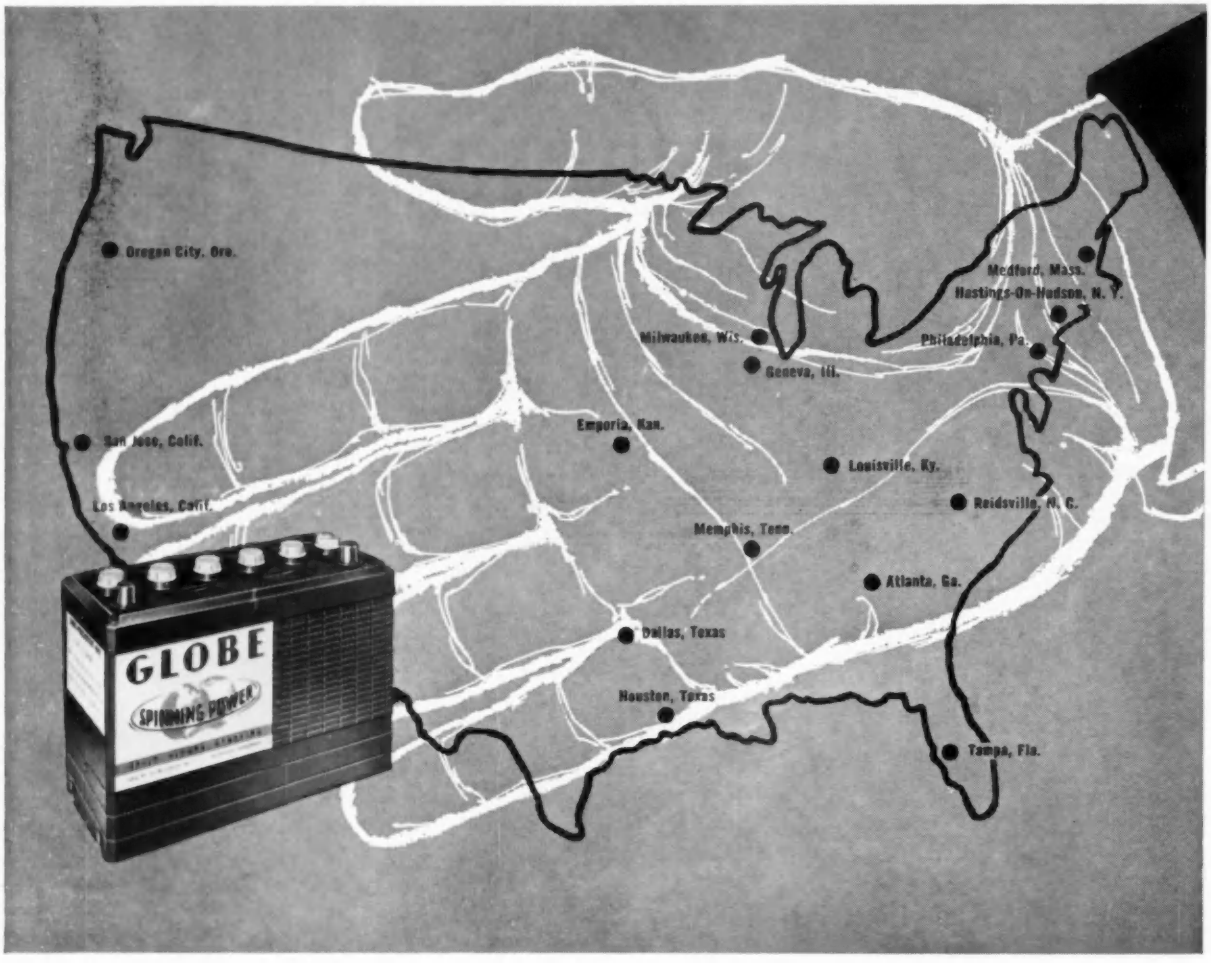
OWOSSO DIVISION M-R OWOSSO, MICHIGAN

ONE OF THE "400" LARGEST AMERICAN CORPORATIONS

AIR BRAKES • AIR COMPRESSORS • AIR CONTROLS • VACUUM POWER BRAKES • DIE CASTINGS • CONSOLIDATED TRANSPORTATION EQUIPMENT

Globe-Union's 16 strategically located plants say:

WELCOME NEIGHBOR!



Never more than a handshake away — they tailor national distribution to local economy

Globe-Union's neighborly hand stretches across the entire country, promoting national battery distribution at low, local-level prices. Globe's 16 strategically located plants assure you faster service . . . lower freight costs. You can always be sure there's a Globe outlet "right around the corner" — whether you're near the Pacific or in the heavily populated northeast.

And no sacrifice of quality in battery manufacturing, either. Identical processes utilizing the most modern equipment are employed in EACH factory. This means Globe-Union products and service are *uniform*. Whatever your battery requirements may be — large-volume original equipment or for regional distribution — you will find Globe-Union service first, fastest and finest!

SPINNING POWER
GLOBE-UNION
SPLIT-SECOND STARTING

GLOBE-UNION INC.

MILWAUKEE 1, WISCONSIN

If it's Petroleum-powered there's a GLOBE-BUILT BATTERY right from the start!

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Roebling Tire Bead Wire: Packaged for Maximum Benefit

The problems eliminated by this unique reel-less core packaging system are manifold. Loads are palletized two cores per pallet and may be stacked two or three high. This, plus the fact that you need not accumulate empty reels means storage space requirements are cut to *less than half*. You do away with all freight and handling costs on reels, the bother and expense of "bookkeeping" returnable reels, and the freezing of money in reel deposits.

This is typical of Roebling's advanced packaging methods—that makes handling Roebling high-quality wire so much easier. For details on this efficient Roebling Tire Bead Wire packaging method, or information on other types of Roebling wire, write Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

WORKER COMFORT PLUS!

Featherweight Enduron plastic safety lenses are half the weight of glass!

Some workers just can't take the weight of regular safety glasses. But the minute glasses come off the face may be the minute tragedy strikes! Safety frames with B&L Enduron lenses are the answer. They are available in plano and prescription types.

Enduron is a tough, shatterless plastic, with a specific gravity only half that of glass. Its feathery-lightness is of particular advantage in high correction lenses where thickness adds weight, and in nasal fitting problems where slippage occurs.

Enduron is extremely hard, clear and colorless. It is comparable to glass in impact-resistance and resists organic solvents, acids and alkalis in industrial concentrations. There is little or no fogging.

Mounted in strong, durable, Bausch & Lomb safety frames, Enduron lenses give full eye protection with the fullest possible measure of comfort. Want to see samples? Phone your supplier of Bausch & Lomb Safety Products, or write Bausch & Lomb, 98606 Lomb Park, Rochester 2, New York.

Enduron plastic lenses fit all Bausch & Lomb spectacle-type safety frames. Shown above is the popular solid color plastic frame Y-62.

BAUSCH & LOMB

Protection-PLUS Safety Products

protection + economy + worker acceptance

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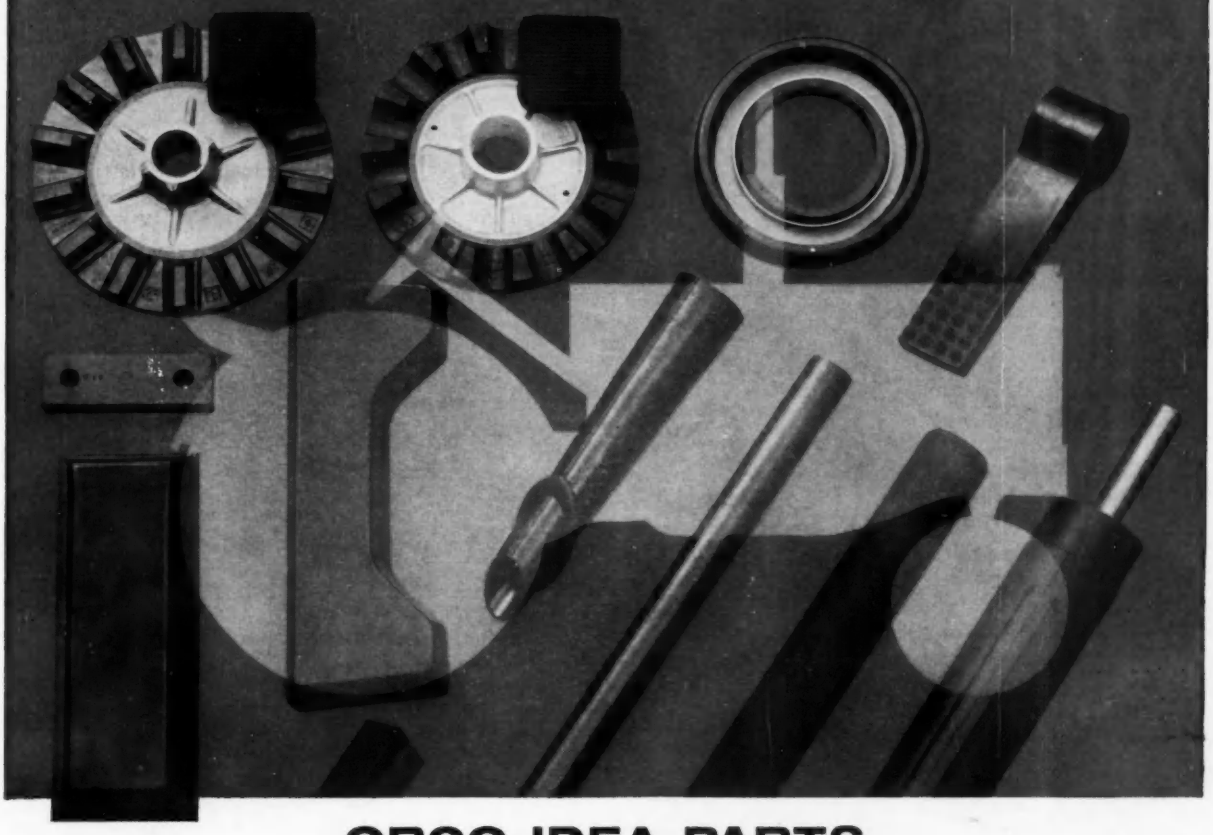
Circle 130 on Inquiry Card for more data

OHIO RUBBER

"CUSTOMEERED* COMPONENTS BASIC TO INDUSTRY"



ORCO IDEA PARTS

cultivate grass-root economy... harvest peak performance

OHIO RUBBER IS THE GOOD SOURCE FOR THE AGRICULTURAL IMPLEMENT MANUFACTURER!

FROM INITIAL CLEARING to final harvest, ORCO IDEA PARTS build-in extra performance, low maintenance for brush clearers, gang plows, planters, cultivators, cotton pickers, hay balers, corn huskers and other agricultural implements. ORCO quality rubber components, functioning as original equipment, are designed for utmost economy —top efficiency.

ORCO "CUSTOMEERING" focuses the full scope of Ohio Rubber's integrated design, research, and practical ingenuity on your component to cut production costs—to deliver a better part.

OVER 75 YEARS of pioneering experience in custom-crafting OEM components of rubber, synthetic rubber, silicone rubber, polyurethane, or flexible vinyl define The Ohio Rubber Company as the industry standard of single source control and responsibility—of product excellence for the agricultural implement manufacturer.

TIRES ARE IMPORTANT TOO! ORCO'S 16-page "Soil King" booklet (Form 429) tells the complete story on tires for agricultural service. Get your free copy of it as well as descriptive folder "ORCO Component CUSTOMEERING" (Form 715) on Ohio Rubber's complete facilities and services for forming rubber.

AG-260

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EAGLE PICHER

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AUTOMATION NEWS REPORT

AUTOMATIC CONTROLS

PRODUCTION—VEHICLES—AIRCRAFT

By C. J. Kelly
ASSISTANT EDITOR

BENDIX NAMED DISTRIBUTOR FOR FERRANTI CONTROL

Ferranti, Ltd., one of the largest electrical equipment builders in Great Britain, has appointed the Bendix Aviation Corporation as sole United States distributor. The Industrial Controls Section of Bendix will handle the Ferranti line which includes a punched tape positioning system, a magnetic tape contouring system and a coordinate inspection machine.

Positioning System

The Ferranti positioning system is designed for rapid point-to-point positioning of work on machine tools performing drilling, machining or boring-type applications. Information stored on punched tape is read by electronic equipment and transmitted to electric motors or hydraulic drives that move the work table simultaneously in two directions.

In addition to positioning data, the punched tape can provide up to twenty-five separate signals to perform auxiliary machine control functions such as down feed, coolant flow, and feed and speed selection. Positioning data on the tape is in the form of absolute coordinates for each point. Two sets of six dials, one for the X coordinates and the other for the Y coordinates, permit manual selection by the operator of any coordinate position up to 99.9999 in.

This control cabinet utilizes magnetic tape to provide a numerical controlled two or three axis system for machine tools. The inset view shows the printed transistorized circuits made up in the form of plug in cards in replaceable drawer type assemblies.

Contouring System

The Ferranti contouring-type control system is designed for application to two and three axis small and medium size machine tools. In this system, information stored on magnetic tape is read by electronic equipment and transmitted to hydraulic servo drives that move both tool head and work table on the machine tool to provide a continuous machining path.

Accuracy of the machine movements is continuously controlled and checked throughout the machining sequence by an optical measuring feedback system utilizing optical gratings attached to the moving machine elements. Use of gratings for feedback permits flexibility in the selection of power drive since accuracy is dependent upon the gratings and not upon loadbearing lead screws or cylinders.

Inspection Machine

The Ferranti inspection machine is designed to cut significantly the time for accurately inspecting work pieces compared with conventional indicator, height gage and surface plate checking methods. This versatile piece of equipment utilizes transistorized electronic counting circuits and optical measuring gratings to inspect machined parts by the coordinate methods to an accuracy of 0.001 in.

Work pieces are mounted on a horizontal surface plate that is an integral part of the machine. To inspect a part, the inspector moves an inspection probe in either longitudinal or transverse directions between the points on the part which he wishes to measure.

Movement of optical gratings attached to both longitudinal and transverse axes of the machine create a fringe pattern that activate photocells. Changes in light intensity are converted into pulses that are stored by transistorized bidirectional decade counters. ■

• • INDUSTRY STATISTICS • •

By Marcus Ainsworth
STATISTICAL EDITOR

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending May 14	Weeks Ending May 7	Year to Date 1960	Year to Date 1959
PASSENGER CAR PRODUCTION				
Total—American Motors	11,404	11,698	202,696	161,152
Chrysler	1,691	1,645	36,689	32,455
De Soto	251	213	14,190	23,897
Dodge	10,654	9,807	168,502	72,292
Imperial	409	.....	7,126	9,233
Plymouth	4,904	4,530	117,573	182,413
Valiant	3,109	6,332	107,059	.....
Total—Chrysler Corp.	21,018	22,527	451,139	320,290
Comet	5,509	4,827	45,039	19,375*
Falcon	10,777	11,372	194,952	.....
Ford	22,213	20,806	447,581	616,796
Lincoln	273	268	9,391	13,240
Mercury	3,069	2,978	73,502	64,035
Total—Ford Motor Co.	41,841	40,253	770,465	713,446
Buick	6,322	4,773	122,411	115,006
Cadillac	3,428	3,386	67,963	68,460
Chevrolet	35,335	36,110	730,350	672,976
Corvair	4,258	5,150	122,653	.....
Oldsmobile	8,782	6,878	164,227	171,574
Pontiac	10,550	8,881	190,642	180,683
Total—General Motors Corp.	68,675	65,178	1,398,246	1,208,699
Total—Studebaker-Packard Corp.	2,665	2,640	50,478	71,412
Checker Cab	207	212	2,969	2,237
Total—Passenger Cars	145,810	142,508	2,875,991	2,477,236
TRUCK AND BUS PRODUCTION				
Chevrolet	8,413	8,158	189,277	158,533
G. M. C.	2,057	2,003	44,929	35,144
Diamond T	42	60	1,151	2,586
Divco	100	100	1,732	1,444
Dodge and Fargo	484	1,514	31,085	33,364
Ford	7,826	7,426	149,839	130,817
FWD	26	16	441	380
International	2,579	2,615	52,961	54,765
Mack	337	342	5,599	6,747
Studebaker	420	509	6,088	5,468
White	401	352	7,445	7,461
Willys	2,331	5,729	54,454	45,884
Other Trucks	100	95	1,615	1,496
Total—Trucks	25,216	28,919	546,616	484,089
Buses	125	80	1,541	1,008
Total—Motor Vehicles	171,152	171,507	3,424,148	2,962,333

*—Edsel production.

NEW FOREIGN CAR REGISTRATIONS*

MARCH

1960		1959	
Volkswagen	14,740	Volkswagen	8,781
Renault	7,951	Renault	6,441
English Ford	2,925	English Ford	3,992
Opel	2,861	Simca	3,694
Fiat	2,407	Opel	3,308
Simca	1,627	Fiat	3,064
Triumph	1,482	Hillman	2,529
Austin Healey	1,454	Triumph	1,958
Peugeot	1,323	Vauxhall	1,756
M. G.	1,308	Volvo	1,635
All Others	12,231	All Others	12,076
Total	50,310	Total	49,234

THREE MONTHS

1960		1959	
Volkswagen	38,224	Volkswagen	22,783
Renault	20,913	Renault	16,697
English Ford	8,546	English Ford	10,312
Opel	7,756	Simca	8,805
Fiat	6,477	Opel	8,308
Simca	4,462	Fiat	8,168
Vauxhall	3,854	Hillman	6,541
Triumph	3,650	Vauxhall	5,071
Hillman	3,505	Triumph	4,750
Volvo	3,472	Volvo	4,360
All Others	32,639	All Others	30,249
Total	133,498	Total	126,044

* Based on data from R. L. Polk & Co.

TRACTOR SHIPMENTS

WHEEL TYPE

Hp Ratings	March	Three Months
9-29 belt hp	2,802	10,052
30-34 belt hp	920	3,275
35-39 belt hp	2,833	7,798
40-49 belt hp	4,316	10,875
50-59 belt hp	4,828	13,654
60 belt hp and over	3,118	9,259
Total	18,817[1]	54,913[2]

TRACKLAYING TYPE

20-59 net engine hp	936	2,829
60-89 net engine hp	379	1,049
90-129 net engine hp	431	1,049
130 net engine hp and over	991	2,703
Total	2,737[3]	7,630[4]

1—Valued at $41,348,000
2—Valued at $119,014,000
3—Valued at $32,632,000
4—Valued at $87,260,000

1960 NEW REGISTRATIONS*

Arranged in Descending Order According to the Three Months, 1960 Totals

NEW CARS

Make	March 1960	February 1960	March 1959	Three Months 1960	Three Months 1959
Chevrolet	158,420	124,745	120,171	385,821	333,741
Ford	125,367	112,899	122,192	340,920	322,625
Plymouth	42,906	33,767	26,197	103,619	73,528
Rambler	38,336	29,123	27,489	92,100	70,445
Pontiac	35,317	29,619	32,356	90,599	85,231
Oldsmobile	31,532	26,721	32,003	82,034	87,927
Dodge	33,063	26,051	10,485	79,200	28,050
Buick	22,852	20,402	22,717	62,275	68,235
Mercury	14,583	13,493	12,907	39,877	35,158
Cadillac	14,081	12,559	12,999	37,628	36,891
Studebaker	10,794	9,032	11,685	27,696	30,934
Chrysler	7,381	6,327	4,607	19,184	12,825
De Soto	2,853	2,515	3,625	7,599	9,759
Lincoln	2,090	2,219	2,660	6,645	7,694
Comet	5,192	.....	.....	5,192	.....
Imperial	1,500	1,423	1,481	4,379	4,244
Misc. Domestic	1,112	579	4,853	2,697	13,166
Foreign	50,310	42,704	49,234	133,498	126,044
Total—All Makes	596,669	494,178	497,651	1,520,963	1,343,497

* Based on data from R. L. Polk & Co.

NEW TRUCKS

Make	March 1960	February 1960	March 1959	Three Months 1960	Three Months 1959
Chevrolet	32,579	24,111	26,291	74,485	73,692
Ford	25,484	21,460	22,376	65,694	59,312
International	9,949	8,194	8,636	25,551	18,625
G. M. C.	7,343	5,150	5,693	16,493	15,967
Dodge	4,259	2,993	6,086	9,912	13,200
Willys Truck	1,838	1,431	1,354	4,564	3,954
White	1,325	1,026	1,310	3,565	3,254
Mack	1,084	852	1,105	2,784	3,032
Willys Jeep	941	627	662	2,138	1,837
Diamond T	252	198	220	655	626
Studebaker	297	138	514	562	1,435
Brockway	119	90	116	297	257
All Others	4,157	3,316	3,383	10,719	9,293
Total—All Makes	89,627	69,588	77,746	217,449	204,484

Chevrolet's High-Rate Forging of Valves

(*Continued from page* 39)

In this second operation, with the metal still hot, of course, a punch of final head size strikes the partly formed head, upsets and coins it to a larger diameter, also making it thinner. At the same time, the die forms the final radius merging into the stem that extends through the hole at the bottom of the die. No flash is formed in either die but stem length varies slightly if there is variation in billet volume. As no flash is formed, all metal in the billet goes into the forging itself.

On the return stroke, forgings are pushed out of both dies and are gripped by the two pairs of transfer fingers, as shown in Fig. 2. These fingers then are moved to the right and, when they release the two forgings, the finished one drops free of the die holder and falls into a chute seen in Fig. 3 and thence slides into a tote tub shown in the right foreground of Fig. 1.

At the same time, the partly formed forging is released into the second die as described above. Fingers then are retracted and are moved backward to clear, subsequently being advanced to position for picking up the forgings after punches make working and return strokes. Fig. 3, taken looking through the opening in the right side of the press, shows the two forgings just before they are released by the transfer fingers holding them. These fingers are operated automatically, of course, and in correctly timed relation to press and punch motions.

Considerable of the lubricant fed into the die is forced out during the cycle and makes exposed surfacs unsightly but greatly reduces die wear and also keeps the transfer mechanism lubricated. Transparent screens protect the operator but enable him to watch the die performance as well as to see the forgings produced. He can stop the press quickly at any time by button control and can easily divert any heated slugs that may cool too much in the magazine if short delays occur.

Although press operation and handling of forgings proceed continuously on an automatic basis and at a high rate, each press is under constant observation by the operator. Naturally, output is much greater than if the billets and forgings had to be fed and removed manually and the press tripped by treadle. It is necessary, however, to provide extra labor to keep the hopper for billets supplied and to move tote tubs as they are filled.

Billet heating is automatic and the hopper fed induction equipment dispenses with furnaces and with feeding and unloading them, not even tongs being required. As induction heaters discharge directly to the forging press magazines, manual handling at this point is avoided.

It is significant that forgings have no flash and that they come from the dies unusually close to finished dimensions, especially as compared with conventional forgings. Stem dia is held to ±0.003-in. limits, as forged, and requires only rough and finish grinding. Machining cuts are made on the top of the head, its OD and at the seat surfaces, but these cuts are relatively light and are made at high speed with only slight loss in chips. Ends of stems are cut off and ground to give uniform length but these are fast and simple operations done in an automatic machine. Economies in the forging operations are matched by those in subsequent finishing with the result that unusually high over all economies are attained.

Reference to the die drawing, Fig. 4, makes it apparent that die costs are moderate. Both the inserts and the punches are circular and are relatively simple to machine. They are subject to wear (as are all forging dies) but replacement costs are moderate and require relatively little time. Holders for inserts are not subject to much wear but each die requires transfer mechanisms and means for operating them. These mechanisms, however, are not complex and cost less than corresponding mechanisms in many other transfer dies. ■

METALS

(*Continued from page* 54)

Copper Statistics Are Contradictory

April statistics released by the Copper Institute showed shipments to U. S. fabricators during the month totalled over 129,660 tons, the highest since last June, and shipments to foreign fabricators were nearly 189,000 tons, another record high. Nevertheless refined production was even larger during the month with the result that stocks increased both here and abroad.

These figures are hard to reconcile with the latest from the fabricators which showed a dismal decline in unfilled orders in March and an increase of about 18,000 tons in their refined stocks. The conclusion seems justified that the producers were pushing off their metal on their captive fabricators and the big April shipments did not necessarily reflect actual consumption by users.

Lead Demand Improves

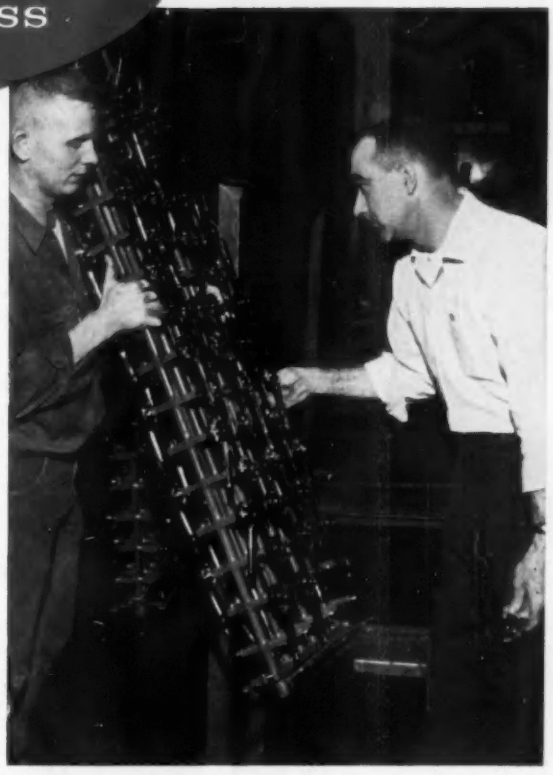
After a long period of slack business, sales of lead turned upward in May in an active market. Demand was well diversified between large and small consumers. Prices gained in London. Reflecting optimism over the outlook, St. Joseph Lead Co. has authorized an increase in the capacity of its Herculanium smelter from 100,000 to 150,000 tons a year. However, the additional capacity won't come into production for another two years. Shipments of automotive replacement batteries are showing a healthy increase over a year ago.

Sales of lead in mid-May were the highest since January, which represented rather abnormal buying at that time. ■

udylite

Bi/NICKEL PROCESS

proves "seaworthy" ...provides a better way to make marine hardware



A knotty problem has been solved for the Middleville Engineering and Manufacturing Company, makers of Jervis marine hardware, with Udylite Bi/NICKEL. Now die castings, automatically plated with Bi/NICKEL, are replacing the more costly brass used in the manufacture of boat fittings.

Costs have been materially reduced. More intricate and beautiful shapes are possible. And, with Bi/NICKEL the manufacturer is able to produce a finish that more than meets the exacting requirements of the product.

Udylite Bi/NICKEL has proved as effective afloat as ashore where it has already met the CASS and Corrodkote test requirements. Highly resistant to the corrosive effects of salt sea spray, Bi/NICKEL is the ideal finish for marine hardware that looks better and stays looking better longer.

Your product too, may benefit . . . your production problem may be solved with the application of Udylite super bright Bi/NICKEL. Inquire today of your Udylite man or write directly to:

the udylite corporation

world's largest plating supplier

Detroit 11, Michigan

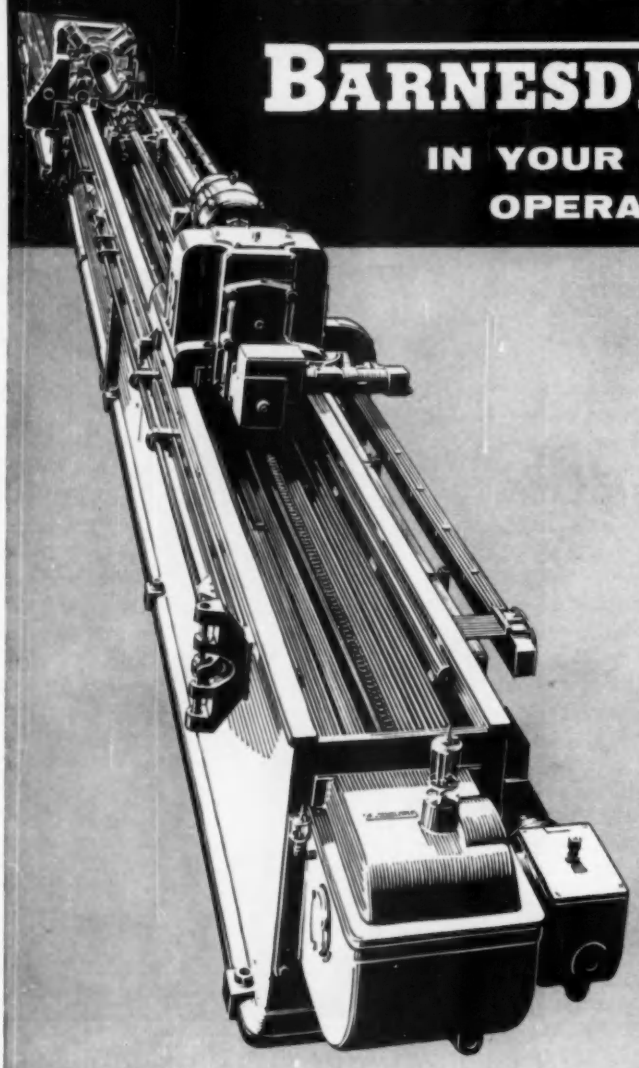
on the west coast: the L. H. Butcher Company

Circle 132 on Inquiry Card for more data

CONSIDER THE ADVANTAGES OF

BARNESDRIL HONING

IN YOUR MACHINING OPERATIONS . . .

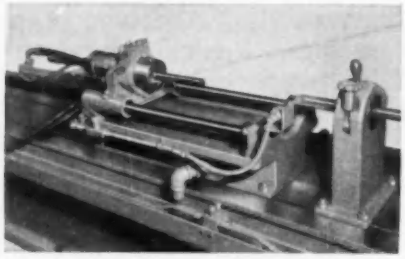


● Fast, accurate, economical metal removal to tolerances measured in tenths of thousandths . . . uniform finishes from 1 to 100 RMS . . . at production speeds. BarnesdriL Honing Machines combine the advantages of geometric accuracy — axial straightness, diametric roundness, and diametric straightness — with metal removal rates comparable to grinding operations. Compensation for stone wear, rapid tool expansion, hone feed, and tool collapse have been integrated as part of the machine function . . . all blended into smooth, fast-reversal stroking by BarnesdriL's exactingly engineered hydraulic drive system.

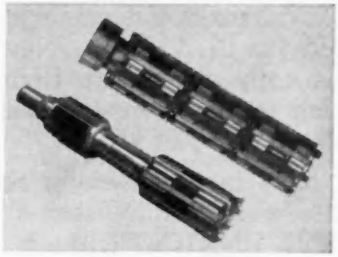
BarnesdriL Horizontal Honing machines range in size from Model No. 1 with capacity to 11' length to Model No. 36 for lengths up to 90'. Large capacities and fast metal removal rates make these machines ideal for honing commercial tubing. An additional BarnesdriL feature . . . short stroking at any point in the bore . . . insures a uniform bore size. Electric hone expansion provides continuous control of pressure and automatically compensates for stone wear.

For fast, accurate metal removal . . . consider honing. And, by all means, consider BarnesdriL. We offer a complete line of Vertical and Horizontal machines in a wide range of sizes for internal or external honing. *Write for catalog No. 550 TODAY!*

Speed range and hone expansion can be adjusted electrically in seconds without leaving this conveniently located control panel.



Plugmatic ganging mechanism, a BarnesdriL exclusive, gives positive, automatic sizing from bore to bore on production work.



BarnesdriL engineers can select from a complete line of tools and abrasives to exactly suit your particular honing requirements.

BARNESDRIL

HONING MACHINES

Honing Machines / Production Units / Filtration Units / Drilling Machines

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AIRBRIEFS

By R. RAYMOND KAY
PACIFIC COAST EDITOR

You don't hear bearish talk among light-plane producers. They're riding high. Sales this year should hit $200 million — compared with $25 million in 1950.

Reasons for Boom in Light Planes

Why the boom in business flying? Leddy Greever, vice-president, Beech Aircraft Corp., Wichita, Kan., gives these reasons: (1) Increased business competition; (2) Plants scattered all over the country; (3) Companies discovering the time-saving benefits of owning their own planes.

"And we're barely off the ground," he says. Mr. Greever predicts the industry will double its annual volume by 1965 and double it again by 1970.

Four firms—Aero Design, Beech, Cessna, and Piper—have the field. They make over 95 per cent of the dollar volume in business and utility planes.

It's no secret in the industry that some of the major airframe companies are eyeing the light plane market.

Mr. Greever believes that there won't be any revolutionary changes in business plane design in the next ten years. The piston-engine type will dominate the market. And the bulk of the business fleet by 1970 will be in the 150 to 300 mph speed range.

More Aircraft for Army

What's the future for manned aircraft in the Army? Very promising, says Lieut. Gen. John C. Oakes, Deputy Chief of Staff for Military Operations, USA.

The General told the Aviation Writers Ass'n that Army plans call for 8000 new aircraft of seven different types by 1970. That compares with 5500 aircraft of 15 different varieties Army now operates.

"We see no point in time where any form of mechanization will replace the soldier, either on the ground or flying just over the tree tops," General Oakes says.

Vice Admiral R. B. Pirie, USN, Deputy Chief of Naval Operations (Air), informed AWA members that Navy is the biggest customer for combat aircraft. In fiscal 1960, Navy bought 629 planes.

The Admiral says his service is now operating 7200 planes. "To keep our inventory at this level we would have to procure about 1200 aircraft yearly. But with budget limitations, we have been able to buy, in recent years, only about half of what we need," the Admiral reports.

Net Earnings Low

Profits of the 12 top aircraft and missile makers slid again last year. The group rang up over $7 billion in sales. But their net earnings were only $70 million, nine-tenths of one per cent per sales dollar.

During most of last year, the aerospace industry was the nation's No. 1 manufacturing employer with 734,700 workers. Next in line was the automotive industry with 728,400 workers.

However, by December, their positions were reversed. Automotive industry employment jumped to 770,000, while aerospace dropped to 700,000.

Some 9500 military and civilian aircraft were turned out in 1959. This compares with 10,882 the year before. The 1959 figure includes 7689 civilian planes and an estimated 2000 military aircraft. The big drop was in military aircraft production.

Latest Developments in Welding

What's new in welding technology? Well, if you attended the American Welding Society's annual meeting in Los Angeles recently, you learned a lot about it.

Engineers from all over the country heard about the latest developments in the industry. And they saw $3 million worth of welding equipment, products, and accessories.

Here are some highlights of the 71 technical papers:

A new development among missilemakers is use of tungsten-arc spot welding where the weld area is blanketed with a gas to protect the metal from the atmosphere. This is used on jet aircraft components for spot welding inconel. Most spectacular results are reported with a tape-controlled programmed tungsten-arc spot welding machine for the fabrication of missile fins.

By use of controls problems of welding thin-gage metal now used in airframe and space vehicles can be solved. Research into behavior of metal foil under the influence of heat shows that current welding practices are O.K. if you can determine the speed of heating. Digital computers show that the problem can be solved by use of new automatic welding controls.

A new group of arc welding techniques cuts production welding time over 60 pct. A welding operation, which takes 15 min. using standard arc welding electrodes,

(*Turn to page* 91, *please*)

Ford's Modernization in England

(*Continued from page* 47)

ing push-button controlled, and stretches a total length of nine miles. Well over 1000 bodies in the various stages of paint and trim may be carried on the system at any one time.

Kings proposed their "dual duty" overhead conveyors as the most advanced conveyor for automatic handling. Full-sized prototypes, both overhead and floor conveyors, were built at King's Stevenage works to test, check and demonstrate the handling of sample car bodies to Ford engineers before they began to install their first conveyor section.

Receiving its bodies from its overhead conveyor on the first floor the "dual duty" system divides into two parallel and similar conveyor lines to allow two complete lines to be processed simultaneously. It passes the bodies into storage, from which they are fed, throughout all the painting processes, on overhead and ground level conveyors. It holds them in storage again after painting and then lowers them through apertures in the floor to the trim sections below, where floor conveyors carry them in parallel lines up and down the shop. Meanwhile, engines and suspension members from the chassis group are completed on slat conveyors and carried to the northeast corner of the building where they join the trimmed bodies for final assembly.

This flexible system allows a local controller to divert a body from one conveyor line to another by push-button control through 1200 miles of wiring. It allows for free movement of the fork lift trucks which supply the operators on the trim lines with such components as seats, windows and handles. There are control rooms on each floor to regulate the traffic. The Coventry Climax fork lift trucks operate on a two shift cycle and receive all palletised supplies from Ford's other manufacturing divisions and outside suppliers, carrying them to the assembly line. The fork lifts are reinforced by highly maneuverable electric tugs for all long distance movement. Internal traffic is controlled by a supervisor patrolling in a two-way radio-equipped tug. He is in communication with the control office which relays information about stock shortages and other minute-to-minute problems, allowing nothing to stop things moving.

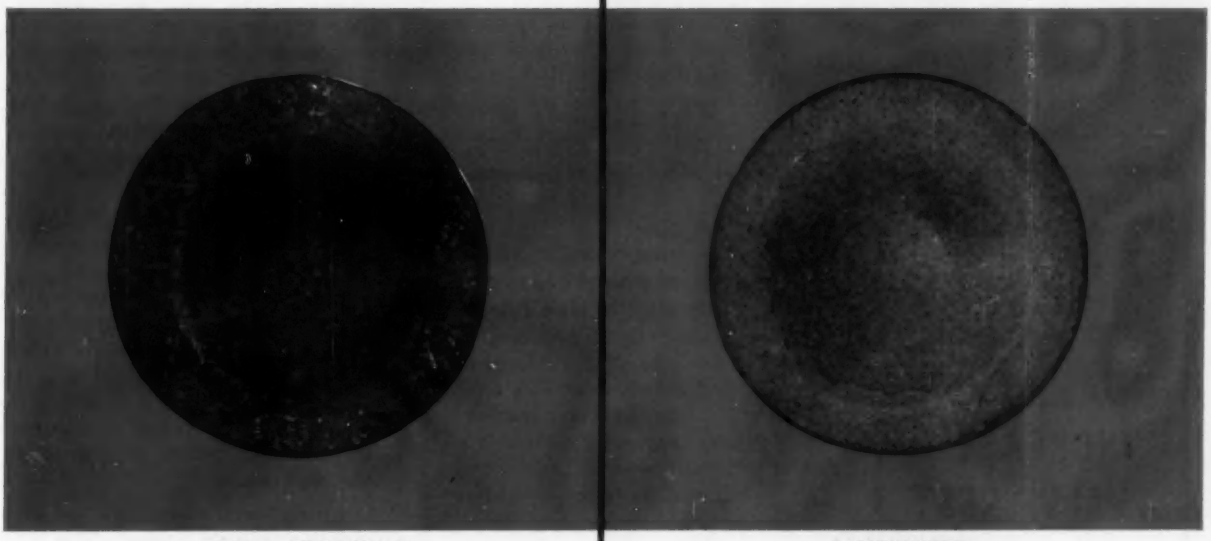
In the paint shop, the bodies move by a planned route which is followed by over 1000 units a day. In the course of it, they are cleaned up manually and passed, in two parallel production lines, on overhead conveyors to a six-stage phosphating machine. They are then conveyed to a blow-off deck and a phosphate dry-off oven and cooler, and passed on raised open decks for the upper dust and water sealing and glazing operations. Next they are automatically transferred round the end of the shop to the slipper dip tank which coats the

SIMPLICITY
in the Heart of the
Modern Diesel Engine
Simple—Only 8" long, 3¼" wide, 5½" high . . . weighs less than 10 pounds . . . fewer parts to service, fewer adjustments to make.
Versatile—Because of accessories that can be built in or added at low cost taking up no, or very little, valuable engine block space.
Economical—Initial cost is less, costs less to service, saves money because of its dependable service.
HMS
makes good diesels better
ROOSA MASTER
Write for guides to better fuel injection. One features the pump, the other an efficient, economical filter.
HARTFORD MACHINE SCREW CO., HARTFORD 2, CONN.
Division of Standard Screw Company

Circle 136 on Inquiry Card for more data

The EATON Process of Aluminizing Exhaust Valve Heads PREVENTS PRE-IGNITION

CAUSED BY INCANDESCENT SCALE



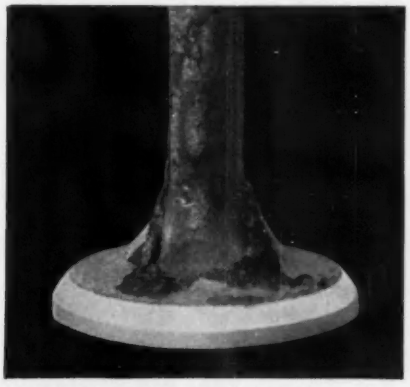
NOT ALUMINIZED
Note Scale which Promotes Pre-ignition

ALUMINIZED
Absence of Harmful Scale Prevents Pre-ignition

Conventional exhaust valve steels, run at high temperatures, tend to corrode and scale, promoting damaging pre-ignition. This condition can be overcome by the use of expensive high-alloy materials. However, there is a simple and less expensive solution to the problem. By applying the Eaton aluminizing process to conventional exhaust valve steel, resistance to corrosion and scaling can be increased tremendously, thereby eliminating a condition which can be a major cause of pre-ignition.

Inlet valves conditioned by the Eaton aluminizing process also are contributing to the increased efficiency, dependability and service life of engines.

Our Valve Division engineers will be glad to discuss the application of Eaton aluminized valves to your engines. Send for illustrated literature.



Aluminizing of Inlet Valve Seat-Face Prevents Oxidation

After aluminizing by the Eaton process, this plain carbon steel valve was placed in an air atmosphere furnace at 2000°F. for 16 hours. Gross oxidation of the base steel resulted. The aluminized seat-face and margin areas were unaffected.

EATON

VALVE DIVISION
MANUFACTURING COMPANY
BATTLE CREEK, MICHIGAN

PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Truck and Trailer Axles • Truck Transmissions • Permanent Mold Iron Castings • Automotive Heaters and Air Conditioners Fastening Devices • Cold Drawn Steel • Stampings • Forgings • Leaf and Coil Springs • Dynamatic Drives and Brakes Powdered Metal Parts • Gears • Variable Speed Drives • Speed Reducers • Differentials • Centralized Lubrication Systems

underbody, inside and out, with a primer of high corrosion resistance; then to a 50-yd drain tunnel and on to the primer spray booth and the primer baking oven.

Ski-type skids are now fitted to the bodies and the overhead conveyor carries them round the shop and lowers them onto floor conveyors, where they undergo the lower sealing process and pass through the wet-sand deck, the water rinse, the wet-sand dry-off ovens and the cooler. Thence they go to an open inspection deck where minor blemishes are rectified prior to enamel painting. The bodies are then turned through 180 deg on a turntable to pass down the next lines—through the ground coat booth, etc. Lastly they are passed into the final enamel booth and the final bake oven to emerge with the six coats of paint they have acquired on their journey. Bodies for "two-tone" finish are selected automatically after enamelling and directed onto the two-tone system. There are 32 primer spraying stations and 54 enamel stations which necessitate 842 take-off points in the paint pipe line.

After painting, the body is lowered to the trim lines on the ground floor where it faces the possibility of being incorporated in many thousands of different combinations of color and trim, glass, drive and mechanical options. The normal demands of the production lines are naturally very much less than this, but such is the tremendous flexibility of the ground floor facilities.

Firstly, the body is conveyed through a series of parallel lines, running north to south and vice versa, in which it is fitted with floor felts, head lining, door trim pads, door handles, door glass, radiator grille, windshield, etc. At the end of each line it is subjected to close inspection and is repaired, if necessary, before it goes on to the next stage.

All the trim operations are carried out on a two-strand chain conveyor and the bodies are transferred from one line to the next by cross-transfer conveyors incorporating power operated lift tables. Though the system is automatic, it is flexible and local controllers can divert a body from one conveyor line to another by push-button methods. Where aisles are crossed, the transfer conveyor is ramped down to floor level for the width of the aisle and then returned to operational height to deliver the body to the next trim conveyor. This means that trim stock can be brought right to the trim lines by truck. When fully trimmed, the bodies proceed through the water test, repair lines if necessary and then to storage prior to delivery to the final assembly lines.

Meanwhile, engines, transmissions, front and rear suspensions, etc. are delivered from the main factory and routed to one of three final lines by floor conveyor. At the same time, wheels and tires are carried on overhead conveyors from their assembly points while another overhead line carries seat cushions. A teleprinter control sys-

(*Turn to page* 88, *please*)

HALL-TOLEDO'S

exclusive "point-contact" principle

GUARANTEES INCREASED

• VALVE SEAT PRODUCTION

• ACCURACY

• at lower cost!

This fast, precision eccentric grinder is completely automated and one of of a series originated by Hall-Toledo. *At 80% efficiency it will produce 540 valve seats per hour, and all seats will be held within .002 in. total indicator reading.*

You may require an even higher rate of production—or as little as five cylinder heads per hour. But whatever your production needs, it will pay you to investigate Hall-Toledo's exclusive, eccentric grinding principle.

Its secret to accuracy is in "point-contact" grinding, which permits precision finishing of valve seats at unbelievably high rates of production.

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HALL - TOLEDO, INC.
2860 South Avenue, Toledo, Ohio

Please send me information describing: Low-production grinders (5 to 20 cylinder heads per hour); ___: High production grinders (20 to 500 cylinder heads per hour). ___

Name_____

Title_____

Company_____

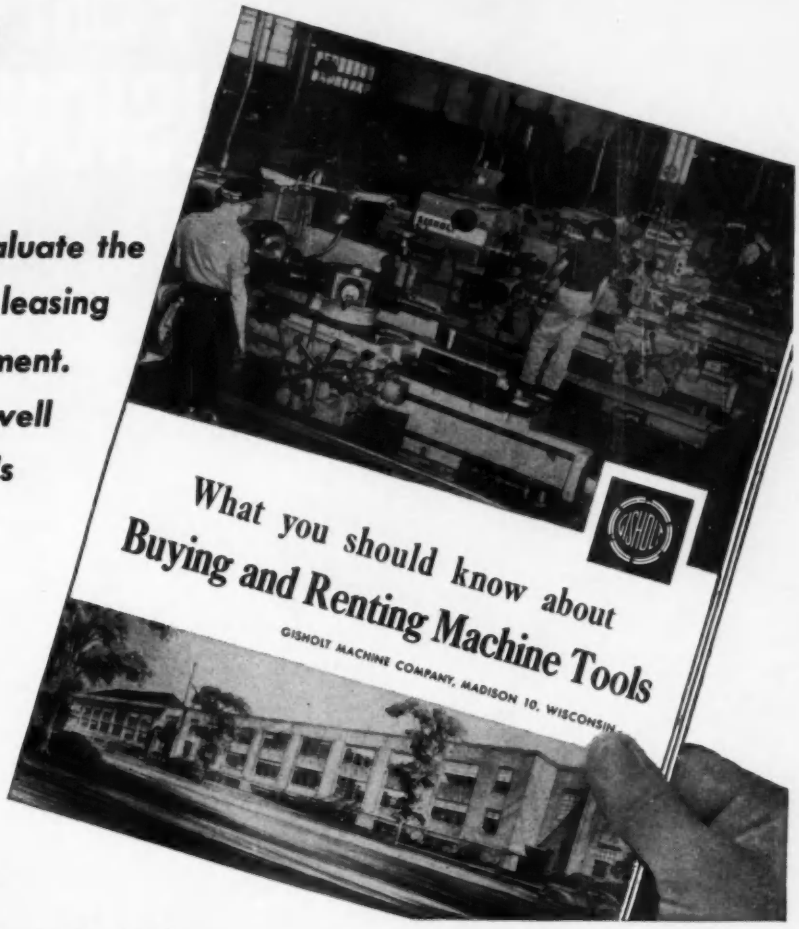
Street_____ Zone_____

City_____ State_____

Circle 134 on Inquiry Card for more data

Can your competitors turn metal at lower costs?

***Now** is the time to re-evaluate the possibilities offered by leasing of new production equipment. Your decision today can well determine your company's position in tomorrow's competitive market.*



This free booklet tells how you can get new machines with minimum capital outlay

If you have delayed replacing old machines because of the relatively large capital investment, acquisition by methods other than outright purchase may solve your problems. Only a minimum initial investment provides you with the many competitive advantages that new machines offer, including greater accuracy, higher production rates and faster setup. New features and accessories simplify even the toughest jobs. Secondary operations are minimized and spoiled work becomes a thing of the past. All this means lower unit cost—more profit for you.

If you want the benefits that new machine tools can provide, and if you like the idea of letting them "pay their way" while they "turn" a profit for you, you'll want to write for Gisholt Bulletin 1173 on buying and renting machine tools. It fully explains one of the most liberal and comprehensive policies in the industry, and covers several types of leasing and time payment plans with vital information on depreciation, tax angles, the MAPI formula and other timely questions. The coupon will bring your free copy. Send it along today.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW-MACHINE GUARANTEE

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Without obligation, please send your Bulletin 1173.

Name.....*Title*.....

Company.....

Street address.....

City.....*Zone*.....*State*.....

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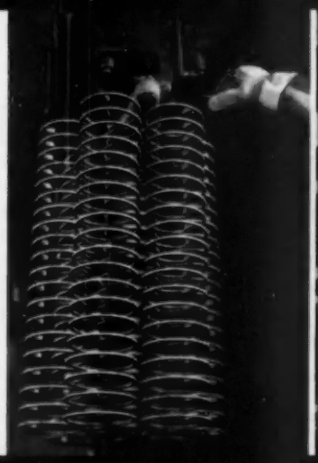
Circle 145 on Inquiry Card for more data ⟶

FROM AMERICA'S LEADING PRODUCER OF PISTON RINGS...

PERFECT CIRCLE PRECISION CASTINGS

STACK-MOLD CASTING

Molds of carefully-controlled green sand are made from the pattern plate, and stacked for pouring. In the example shown above after shake-out, the castings are 6-up in a stack 20 molds deep. Typical castings produced by this Perfect Circle process include piston rings, thrust plates, valve lifter facings and piston groove inserts.



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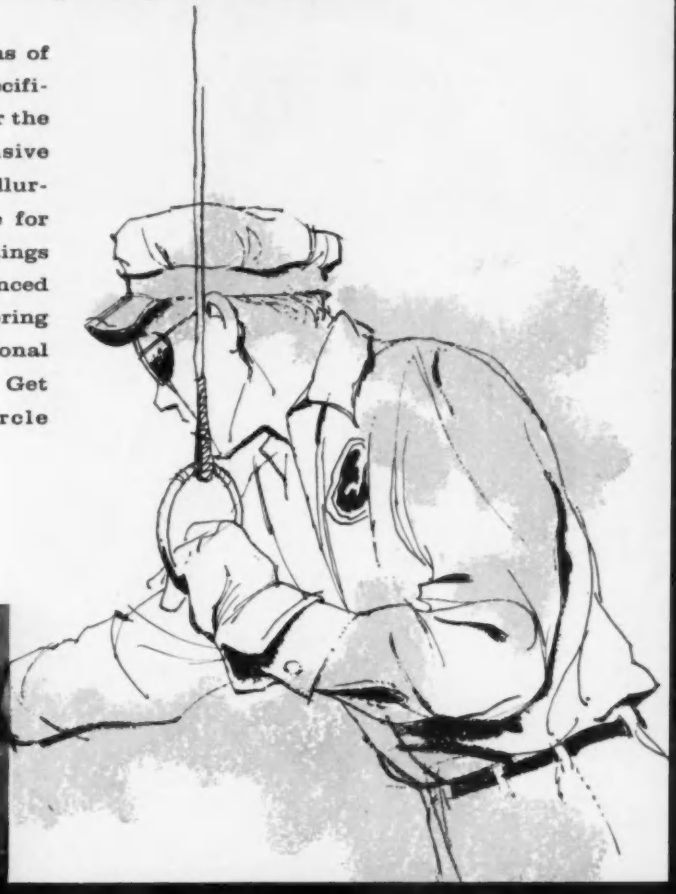

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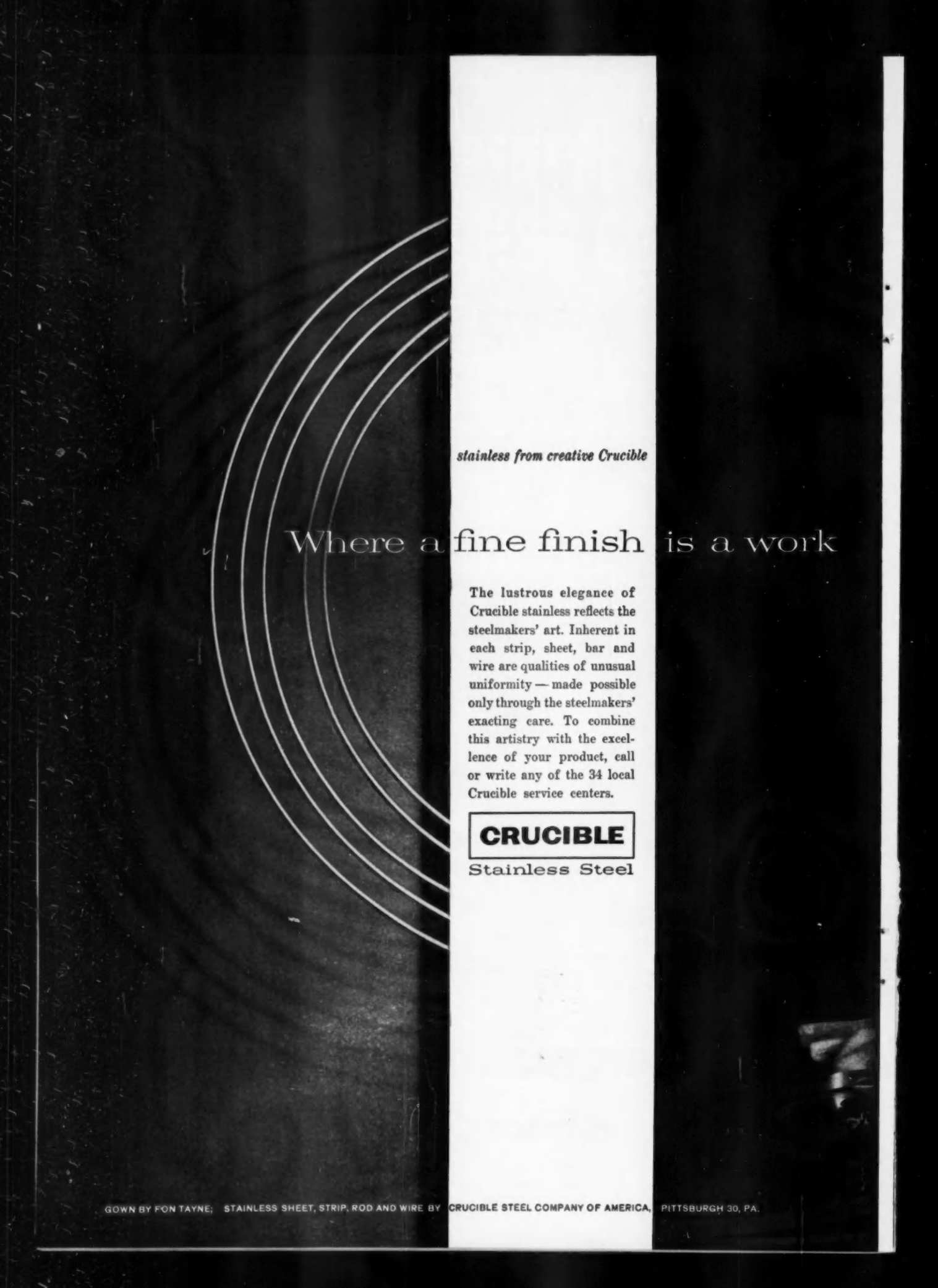
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The lustrous elegance of Crucible stainless reflects the steelmakers' art. Inherent in each strip, sheet, bar and wire are qualities of unusual uniformity — made possible only through the steelmakers' exacting care. To combine this artistry with the excellence of your product, call or write any of the 34 local Crucible service centers.
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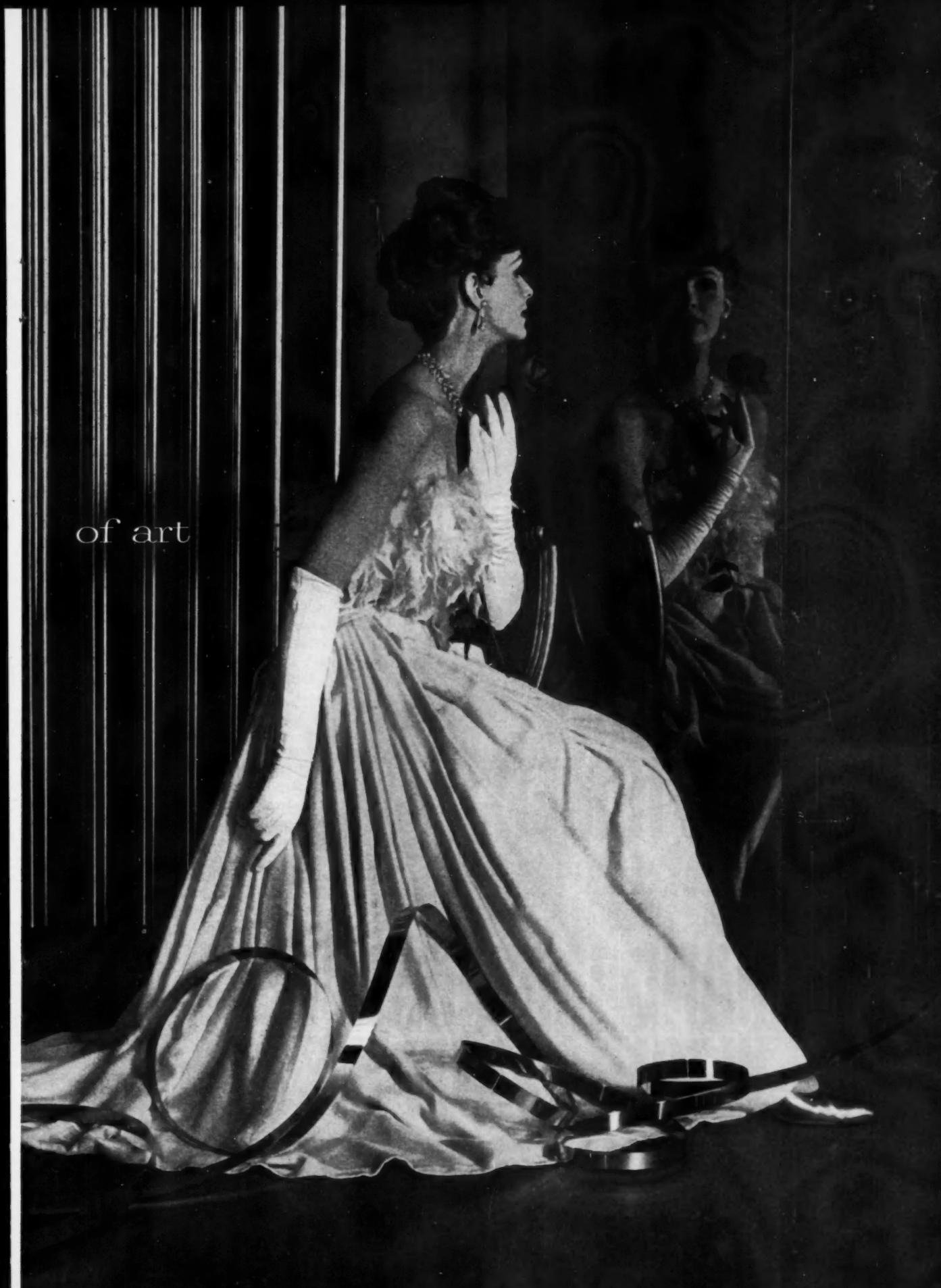
of art

Ford's Modernization

(*Continued from page* 82)

tem regulates this complicated traffic and brings each component to the right point at the right time.

Bodies are lifted from the trim line by overhead conveyor and lowered on to the engines and transmission on the final assembly lines, which run at right angles to the trim line. At the end of the final line the completed car is driven on to wheel alignment pits and on to the roll test—a simulated road test to prove performance of brakes, gears, etc. ■

Simca's Advanced Machining Lines

(*Continued from page* 50)

and one at each end, with load positions at diagonally opposite corners.

Fixtures, spaced out by buffer extensions at front and rear, are advanced along each long leg of the rectangle and onto its outgoing turntable by a hydraulic transfer bar beneath the load station that pushes the last unit in the line forward. The turnatable rotates 90 deg., and the fixture is transferred onto the short leg by an integral drag chain mechanism, causing the previous fixture to be pushed onto the next turntable from where the body is unloaded. After the right-angle turn a similar drag chain advances the empty fixture to the load station of the second long leg, and the cycle repeats.

Incoming floor assemblies are conveyed alternately to one of the loading stations where they are dropped by hoist into the heavy base fixture and pneumatically clamped in place. The pre-assembled cowl, roof and door pillars are brought in by another monorail and roughly positioned by hand.

Now the fixture moves to the second station, where these parts are finally located and locked together by a master jig. This is split down the center into two halves which separate to allow the body to pass between them. On arrival of the fixture the jig closes in hydraulically, and the toggle clamps are manually closed to secure the various body panels which are then tacked together with hand guns.

The jig now splits open and the fixture travels ahead to the third and fourth stations where joint welding of these sections is completed. Turning the corner, the body reaches the fifth work station where the front fender and grill unit is conveyed in and added. Prior to welding this is accurately located by another split jig whose halves are aligned with the base by dowels as they close in. Finally, body shells are off-loaded by a hoist at the next turntable.

The Aronde final assembly line is unconventional in that the front suspension and radiator are not installed until the engine is in place. Power plants and rear axles are carried on paired pedestals on the main slat conveyor that starts out at floor level. When the propellor shaft and exhaust pipe have been added the conveyor rises to waist level, and the unitized body is dropped at the next first station.

First the engine is bolted to the three mounting brackets on the frame members, and the tail of the body is lowered onto the rear leaf springs. Supplementary coils are positioned between the axle ends and the frame before the spring eyes are attached. Springs are then compressed and secured and telescopic shock absorbers added.

Now the front suspension on its sub-frame is swung under the engine compartment by a hooked carrier lowered by hoist from an overhead monorail. The lower valance enclosing the radiator opening is removed and the suspension assembly is bolted to the frame, after which the carrier is detached and withdrawn and the valance replaced.

When underside work is completed and wheels are in place, the conveyor descends and returns under the floor to the start of the line. Cars now roll in guide channels and are advanced by drag-chain. In this final section the radiator, steering gear and other components are installed, and cars then move on to final inspection. ■

DISCERNING DRAFTSMEN THE WORLD OVER DEMAND IMPERIAL THE WORLD'S FINEST TRACING CLOTH

1506

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←——— Circle 137 on Inquiry Card for more data

"Team Concept" at Mack Truck in Buying Steel Products

(*Continued from page 53*)

ventory by periodically reordering items that are normally carried in stock. They also determine whether to buy steel in mill quantities depending upon the length of the production run and the availability of space to carry the inventory.

Q: After a buying decision is reached, who in the organization has the authority to change it?

A: Only the Purchasing Agent—on the basis of recommendations by a top executive from Engineering, Manufacturing, or top management.

Q: Do you have an established corporate policy that defines areas of responsibility for buying and purchasing?

A: Yes. The Director of Purchases is responsible for maintaining inventory control, establishing sources, placing orders and effecting delivery, and his delegated authorities bring this about.

Q: Who is responsible for ordering steel in large quantities involving large sums of money?

A: The specific quantity of steel is determined by the Central Planning Division of the Procurement Department and signed by the Supervisor of the Steel Group. The quantity is dependent upon the number of parts to be made, sales forecasts from top management, length of the run, amount of inventory space, and the amount of money that management will allow to carry steel inventory.

Q: How far ahead of cutting do you buy steel?

A: Purchase Orders are placed on the basis of known mill schedule lead times to effect delivery 60 to 90 days ahead of cutting.

Q: What factors are considered when designing a part or assembly away from steel?

A: Adaptability and weight. The most important factor for us is weight. Highway truck purchasers want reduced weight due to the added payload it affords within regular rated limits. There is a continuing development for uses of lighter materials.

Many trucks are made in two versions, one heavy and one light. The latter uses aluminum in place of heavier materials for bumpers, hoods, fuel tanks, air reservoirs, brakeshoes, brakes, axle brake chamber brackets, etc.

Q: What role does Quality Control play in the purchase of steel?

A: They exercise rigid control on many steel parts such as axle shafts, gears, engine components, clutches, etc. Every buy is checked thoroughly. Physical testing is done in our laboratory and from time to time they request test and pull bars.

For all military contracts, certificates are required from the vendor.

Q: Whom do steel salesmen normally call on?

A: Purchasing first, Engineering and/or Manufacturing only on request.

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Proved by more than 25 years use in the Automotive Industry

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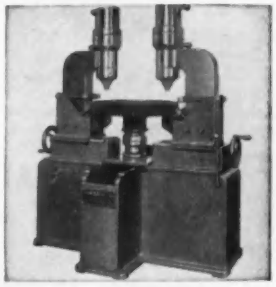

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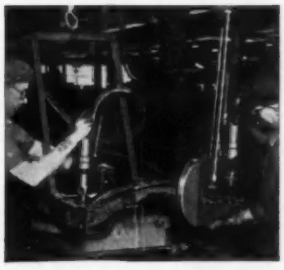

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Instantly demagnetize tools or production parts. No moving parts. 110 v., 60 cy. A.C.
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Ship. wt. 55 lbs. $78.00
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Ship. wt. 35 lbs. $54.00
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3¾" openings
$27.50
LATHE
4-JAW INDEPENDENT
3-JAW UNIVERSAL
RECTIFIERS A.C. input 110 volts; D.C. output 110 volts. P-1 for 5½" x 12" chuck 0.8 amps. $57.50
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Manufacturers' News

Record Lindberg Earnings

Record 1959 sales and earnings for Lindberg Steel Treating Co., Inc., have been announced by L. A. Lindberg, president. Net sales last year totaled $5.9 million, compared with $4.2 million in 1958. Net earnings were $549,893, equal to $1.93 a share, against $156,609 and 55 cents a share in 1958. Sales for the quarter ended March 31 approximated $1.6 million, compared with $1.3 million for 1959's first quarter.

Fork Lift Business Sold

Minneapolis-Moline Co. has purchased the fork lift truck business of Lamson Mobilift Corp., Portland, Ore. The Mobilift truck operations will be transferred to the Moline plants in the Minneapolis area. In January, Moline acquired the John Morrell Mfg. Co. Moline offers fork lifts powered by diesel fuel, LP gas, gasoline and electricity.

Mather Spring Diversifies

The Mather Spring Co., supplier of suspension systems and chassis components to the automotive industry, has acquired the Lus-Trus Corp. as part of a diversification plan. Lus-Trus plastic sheets, shapes, tubes and monofilaments are widely distributed in the automotive, agricultural, packaging and consumer products fields.

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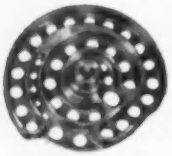

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Camshaft for Internal Combustion Engine

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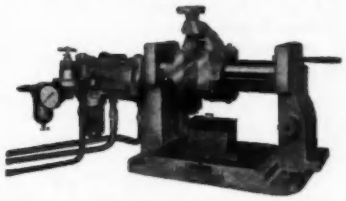
40 Characters all interchangeable. Standard sizes range from 1/16" to ½". Write for Color Folder.

No. 1F

No. 1

Model 9 Pneumatic Marking Machine



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Performs all operation including serial numbering. Slide feed provides absolute safety. Write for Catalog No. 1 and 2A.

PERIPHERAL MARKING MACHINE Model 9AM

Marks precision calibrations and graduations around dials. Uses flat dies to mark rounds and roll dies to mark flats. A high production machine that will not break even brittle plastic parts. Write for Catalog No. 9AH.

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"The Original Marking Specialists"

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ON OUR WASHINGTON WIRE

From now on, Congress is going to put once-sacred atomic energy money proposals through its normal chopping process. Congressional leaders warn they no longer will OK all the funds atomic scientists requested. Some $82 million was pared from next year's research and construction funds of the Atomic Energy Commission.

The Nation's defense leaders have disclosed they may soon set up a super command to include the most powerful nuclear weapons of the Navy and Air Force. The plan is to link the Strategic Air Command and Polaris missile submarines under a joint setup, presumably headed by an Air Force officer.

AIRBRIEFS

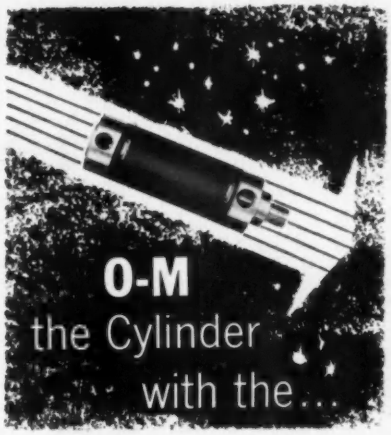
(*Continued from page* 79)

takes only 5 min. with the new methods.

Missile fuel tanks made of aluminum alloy 2219 show reliability. The alloy has a high tolerance to forging and welding discrepancies.

Solid Propellant Ballistic Missiles

Current designs of solid propellant intercontinental ballistic missiles call for assembly by arc welding. This led to new welding and heat-treating methods. Terrific pressures are involved. And the tremendous strains on the thin metal make it essential that all joints are sound and of maximum strength. Weld geometry showed how to transfer the load to the strongest part of the casing. Filler metal combinations which are slightly softer and more ductile were picked for certain joints. High strength ductile welds resulted. ■



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Bulletin 101A for Internal Key Tie-Rodless-Type Air and Hydraulic Cylinders featured above.

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Bulletin 107—Automation (Heavy Duty) Air Cylinder for 200 psi operation.

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All O-M Cylinders are available in ½" to 8" bores with standard, oversize, or heavy-duty rods. Complete line of mounts and interchangeable parts. Immediate delivery on most sizes. MAIL COUPON TODAY.

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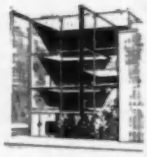
A CHILTON  PUBLICATION

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By C. J. Kelly
ASSISTANT EDITOR

Engineering Handbook 1

A new industrial fan bulletin devotes 17 pages to pertinent engineering data on industrial exhausting, blowing and drying. The engineering section includes air volume tables, corrosion data, drying temperatures for a variety of processing requirements, piping information and many engineering facts for a mechanically sound exhaust and blowing system. *General Blowing Co., a Subsidiary of Ilg Electric Ventilating Co.*

Coolant Solution 2

A "Better machine production" section is included in a new brochure that covers a chemical machining "Tool." Charts and graphs, along with trouble shooting hints and other important information, are included in this 27 page publication. *Master Chemical Corp.*

Tungsten Alloys 3

Specifications such as chemical composition, density, hardness, tensile strength and many others are in chart style in a six page booklet covering a line of heavy tungsten alloys. *Kennametal Inc.*

Weld Equipment 4

Gas-shielded metal-arc welding equipment is discussed in a newly revised brochure that shows illustrations, a schematic drawing, specifications and it incorporates all recent equipment that has been developed. *The Air Reduction Sales Co.*

Transfer Units 5

Cut-away views, illustrations, design and technical information all serve to complete the picture of a line of transfer units. These units are designed to be applied to press and machine automation operations. *Livernois Engineering Co.*

Oscillograph Data 6

Designed as a reference book for engineers and scientists, this booklet contains 18 case history descriptions of how Visicorders have been used in various ways. Included are reports on applications in providing high-frequency analog data in industry, Diesel engine testing, and nuclear instrumentation. *Heiland Div., Minneapolis-Honeywell Regulator Co.*

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Testing Units 7

Various types of test equipment are described and illustrated in an eleven page booklet. It contains a conversion chart that shows the relationship between values determined on Rockwell, Rockwell superficial and Tukon hardness testers, and values determined on other testers. *Wilson Mechanical Instrument Div., American Chain and Cable Co., Inc.*

Tractors 8

Three new pieces of literature cover several pieces of farm equipment. They include interesting data on design, construction and use of this equipment. Illustrations of the units in actual operation are shown along with specification charts. *Allis-Chalmers Mfg. Co.*

Pure Air Filter 9

New concepts and advanced designs for filter manufacturing are described in a four page folder. It contains a drawing, graph and chart to cover the design and technical data. *Arco Mfg. Corp.*

Fork Truck Data 10

A complete analysis of each main working part of a 7,000 lb capacity fork truck is shown in a new four page booklet. Included also are photographs, diagrams and illustrations of safety designing. *Elwell-Parker Electric Co.*

Bus Duct Data 11

Application data, illustrations, line drawings of typical applications and federal specifications are shown in a 12 page bulletin. Charts list the specifications for quick reference. *Westinghouse Electric Corp.*

Drop Forgings 12

A 16 page, illustrated brochure outlines diversified design, engineering and processing services available in the production, machining, coining and finishing of ferrous forgings for the automotive, aircraft and farm machinery industries. It includes case histories, step-by-step production illustrations, information on improved techniques and cost-cutting engineering approaches in product development. *Union Forging Co.*

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Terminals 13

Compression terminals are discussed in a folder that shows various sealed terminals in 18 different colors. These colors correspond to a color coded chart that contains the various specifications of the line. *Electrical Industries, a Div. of Phillips Electronic and Pharmaceutical Corp.*

Engine Quality 14

A booklet titled "Judging Engine Quality" was published to aid purchasing personnel in deciding what is needed and which is the best for a particular need. It covers cost of operation, reliability, design, quality and parts and service availability. Charts, graphs and illustrations are included in the 27 page booklet. *Caterpillar Tractor Co.*

Brazing Alloys 15

Analysis and comparisons of various low temperature brazing alloys are found in a new four page folder. Included are low fuming bronze, nickel silver, silver solder, and others. Comparison charts are also shown *American Brazing Alloys Corp.*

Various Tools 16

Many different and improved types of holding tools and collets are described in a 34 page booklet. It covers application data, specification information and numerous product illustrations. Charts and dimension drawings are included in this publication. *Erickson Tool Co.*

Cutting Fluids 17

Various types of cutting fluids are described in a six page folder. It contains a chart that is divided into seven classification sections, and covers the different grades in each section. *The Texas Co.*

Fastener Data 18

A data sheet describes a special fastener for use where the strength of a bolt is required but where fast opening and closing are desirable. Illustrations and line drawings add to the coverage given by the "feature" information. *Simmonds Fastener Corp.*

Balancing Machines 19

Two complete lines of static-dynamic balancing machines are described in a new 20 page brochure. Special adaptations for automobile engines and jet aircraft engines are discussed along with an informative dissertation on the nature, causes and correction of unbalance. Schematic diagrams of four different balancing methods, compensator, nodal bar, pivoted cradle and electrical network, are also given. *Tinius Olsen Testing Machine Co.*

Automation Aid 20

Two data sheets show dimensional details and specification information on a complete line of control units that were designed for precision control operations. A seven part chart shows the advantages of this line. Line drawings and illustrations are included. *Paramount Textile Machinery Co.*

Equipment Catalog 21

All the new information available on a complete line of manual, semi-automatic and automatic Heliwelding equipment (tungsten-inert-gas welding process) has been included in a 24 page booklet. Illustrations, charts and specification data cover the line and its accessories. *Air Reduction Sales Co.*

Shut-Off Valve 22

Schematic drawings, illustrations and a flow capacity chart cover a line of valves that have been designed to be employed in applications on gas or oil lines that lead to industrial boilers, furnaces, industrial ovens and numerous other areas. *Maxon Premix Co.*

Marking Device 23

A line of marking devices are described in a four page folder. Illustrations, design data and typical applications are included in this publication. *The Acromark Co.*

Broaching Tools 24

The seven factors that are essential in a broaching tool are discussed in a 12 page, well illustrated brochure. *National Broach and Machine Co.*

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Industrial Wheels 25

A new agricultural and industrial equipment wheel catalog contains full information and technical data on the company's line of "Application Engineered" wheels. Also listed are such wheels as: SAE; trailer; off the road; tractor; implement; variable tread tractor and power adjusted wheels. This 50 page catalog is completely illustrated and contains a cross reference section. *Motor Wheel Corp.*

Carburetors 26

Small-engine carburetors used on machinery, garden equipment, and marine inboards and outboards, as well as on a variety of other engines, are the subject of a new catalog. Exploded views and illustrations, along with numerous specification charts, give quick reference for any application. *Carter Carburetor Div., ACF Industries, Inc.*

Welding Data 27

A comprehensive brochure on resistance welding includes: a special report; fabrication of aircraft wings; and manufacturing of European cycles. Many illustrations are included in this publication. *Sciaky Bros., Inc.*

Hoist Specifications 28

The Hoist Manufacturing Association is offering a six page booklet containing tables and recommended minimum standards on lever operated type hoists of ratchet and pawl design, and load brake design, using roller or link coil chain. *Hoist Mfg. Association.*

Diamond Wheels 29

A new and comprehensive catalog describes a complete line of diamond wheels. Included in this catalog is detailed data on grit sizes and diamond concentrations, wheel markings, recommendations for prolonging wheel life, and ordering information. Use of this catalog permits positive selection of the proper material for a specific application. *Abrasive Wheel Dept., Manhattan Rubber Div., Raybestos Manhattan, Inc.*

Atomic Energy 30

A new bulletin describes and portrays some accomplishments in design and construction of reactors both here and abroad. The booklet includes information on the many resources and services that can be provided by the *Atomic Energy Div. of the Allis-Chalmers Mfg. Co.*

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